National Aeronautics and
Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

NASA

Reply to Attn of: 832.3

JUL 16 1992

TO: 100/Director

FROM: 832.3/COMET Project Engineer

SUBJECT: Results of the Environmental Assessment (EA) for the Launch of the Conestoga Launch Vehicle from GSFC/WFF

EER Systems has proposed launching a Conestoga launch vehicle for the COMET program from GSFC/WFF. As a commercial launch services provider, EER is required to comply with all federal and state regulations. GSFC/WFF has coordinated EER's development of the enclosed EA for this program. A Findings of No Significant Impact (FONSI) has resulted from this EA. Advance copies of both documents have been provided to GSFC/WFF (Code 140) and NASA Headquarters (Code JXS).

Your review and signature of the FONSI is requested by July 29, 1992. As a completion to this regulatory process, copies of the signed FONSI will be published in the local newspapers, and copies of the signed FONSI and EA will be filed at the local library. The original will be maintained by Code 205 at GSFC/WFF.

Peter M. Martini

Enclosure

80.03.32 3764

ENVIRONMENTAL ASSESSMENT OF THE PROPOSED LAUNCH OF THE COMMERCIAL LAUNCH VEHICLE, CONESTOGA, FROM THE NASA GODDARD SPACE FLIGHT CENTER/ WALLOPS FLIGHT FACILITY AT WALLOPS ISLAND, VIRGINIA

Prepared for the
EER Systems Corporation
1593 Spring Hill Road
Vienna, Virginia 22182

For Submission to
National Aeronautics and Space Administration
Goddard Space Flight Center/Wallops Flight Facility
Wallops Island, Virginia

Prepared by
Reynolds, Smith and Hills, Inc.
4651 Salisbury Road
Jacksonville, Florida 32256
904/296-2000

RS&H Project No. 292-0994-001

July 1992

National Aeronautics and
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GLOSSARY OF ABBREVIATIONS

Al	Aluminum
AP	Ammonium perchlorate
CCAFS	Cape Canaveral Air Force Station
CCDS	Commercial Development of Space
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
COMET	Commercial Experiment Transporter
CSLA	Commercial Space Launch Act
CWA	Clean Water Act
dB	Decibel
dB(A)	A-weighted decibels
DOD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EPA	Environmental Protection Agency
ERD	Environmental Resource Document
ft/sec	Feet per second
GSFC/WFF	Goddard Space Flight Center/Wallops Flight Facility
ha	Hectares
HSWA	Hazardous and Solid Waste Amendments
HTPB	Hydroxyl terminated polybutadiene
HW	Hazardous Waste
Hz	Hertz
kg	Kilogram
km	Kilometer
lb_f	Pound (force)
lb_m	Pound (mass)
lbs	Pounds
LOS	Level of service
m	Meter
m/sec	meter per second
mg/l	Milligram per cubic meter
mi	Miles
ug/m^3	Micrograms per cubic meter
mph	Miles per hour
MSDS	Material Safety Data Sheets
msl	Mean sea level

NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NIH	National Institutes of Health
nm	Nautical miles
OASPL	Overall sound pressure level
OSPL	Overall sound pressure level (dB)
OCST	Office of Commercial Space Transportation
OSHA	Occupational Safety and Health Administration
PM_{10}	Particulate matter less than ten microns
ppm	Parts per million
QA	Quality Assurance
QD	Quantity distance
RCRA	Resource Conservation and Recovery Act
RQ	Reportable quantity of hazardous material
RS	Recovery System
SARA	Superfund and Reauthorization Act
sec	Second
SHPO	State Historic Preservation Officer
SM	Service Module
SRM	Solid Rocket Motor
STS	Space transport system
SW	Solid Waste
SWCB	State Water Control Board (Virginia)
TSP	Total Suspended Particulates
USAF	United States Air Force
USFWS	U.S. Fish and Wildlife Service
Va	Virginia
VAFB	Vandenburg Air Force Base
VDGIF	Virginia Department of Game and Inland Fisheries
VDWM	Virginia Department of Waste Management
VPDES	Virginia Pollutant Discharge Elimination System
yr	Year

LIST OF FIGURES

1.0 PURPOSE AND NEED

This Environmental Assessment (EA) addresses the environmental impact of proposed launches of the launch vehicle Conestoga from Wallops Island. The Conestoga is the product of EER Systems Corporation and was selected through a grant from the Office of Commercial Programs to support the Commercial Experiment Transporter (COMET) program. The purpose of the proposed project is to implement the commercial Expendable Launch Vehicle (ELV) program at the Goddard Space Flight Center/Wallops Flight Facility (GSFC/WFF) using operational and launch facilities at Wallops Island, Virginia. This EA will address the environmental impact of the launch vehicle at Wallops Island as well as the processing and loading of the payloads which may occur at Wallops Island. Two launches are proposed in the calendar year 1993. Three launches per year are proposed from 1994 through 1996.

In 1985, Congress passed the Commercial Launch Space Act (CLSA) which recognized that development of commercial launch vehicles were in the national interest. The Department of Transportation (DOT) is the federal authority responsible for regulating and licensing commercial launch operations. Within DOT, the Office of Commercial Space Transportation (OCST) has been delegated licensing responsibilities. The Department of Transportation's 1986 Programmatic EA for ELVs covered all aspects of commercial ELV launches deriving information from past federal ELV launches at GSFC/WFF, Cape Canaveral Air Force Station (CCAFS) in Florida, and Vandenburg Air Force Base (VAFB) in southern California. This 1986 EA addressed potential environmental impacts from ELVs and presented a mitigation overview to limit adverse impacts to the above categories of concern. The Programmatic EA also recognized the need to prepare site specific EAs while implementing the commercial ELV program. As a basis for the anticipated impacts, the Programmatic EA relied upon the following ELV types: Scout, Delta, Atlas and Atlas/Centaur, and Titan and Titan/Centaur. The proposed project at Wallops will use solid rocket motors (SRMs) similar to those incorporated into the 1986 Programmatic EA.

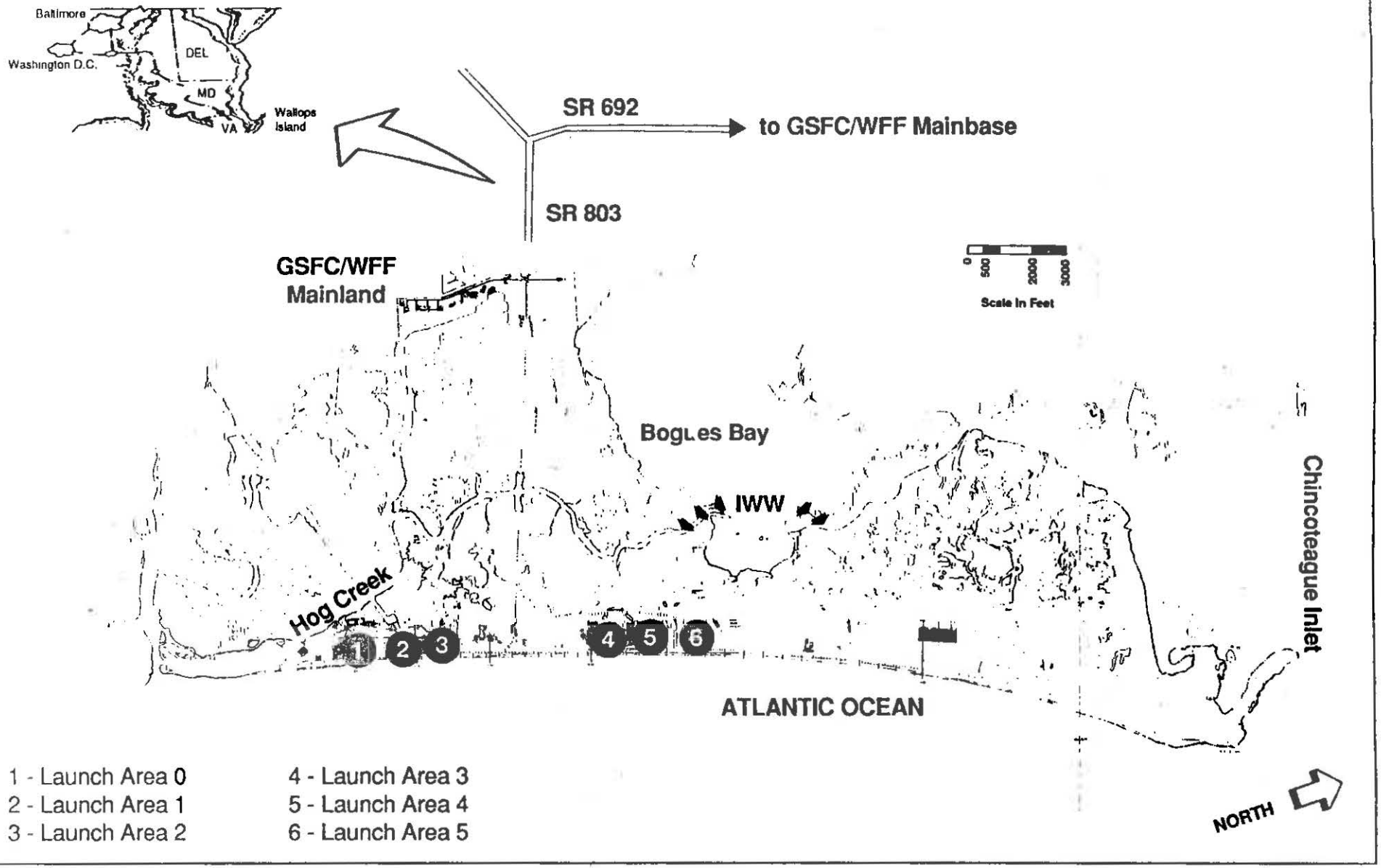

Figure 1
General Location Map,
Wallops Island GSFC/WFF
Source: Facilities Master Plan/Goddard Space Flight Center

SRMs ignite simultaneously. The second stage will be composed of the same components less the four spent strap-ons. The third stage will include the core SRM and STAR 48V-type motor. After separation of the third stage, the fourth stage will include the STAR 48V-type motor, the payload attach fitting, and the COMET payload system. The COMET payload system which includes the Service Module and Recovery System are discussed below. The payloads are described in Section 2.1.3.

Due to their history of use and availability from the manufacturer, these CASTOR-type motors are considered "off-the-shelf" rocket motors. The CASTOR motors noted above are Thiokol-built SRMs. As of November 1991, the CASTOR IVA had a 100-percent successful flight record for 162 motors flown on Delta rockets. The strap-ons and core SRMs will have the following range of properties:

Propellant (lb_m)	22,000 - 22,270
Total Initial Weight (lb_m)	25,104 - 25,204
Burn Time (sec)	56.3 - 61.7
Burnout Weight * (lb_m)	2,934 - 3,126
Average Thrust (lb_f)	95,032 - 95,190
Maximum Thrust (lb_f)	122,431 - 124,175
Primary Propellant Constituents **	68% Ammonium perchlorate (AP) 20% Aluminum (Al) 12% Hydroxyl Terminated Polybutadiene (HTPB)
Propellant Designation	TP-H8299

The upper stage of the launch vehicle will include a STAR 48V or similar SRM. The STAR SRM 48V-like motors have the following properties:

Propellant (lb_m)	4,430
Total Initial Weight (lb_m)	4,764
Burn Time (sec)	84.5
Burnout Weight * (lb_m)	272
Average Thrust (lb_f)	15,130
Maximum Thrust (lb_f)	17,210
Primary Propellant Constituents **	71% AP 18% Al 12% HTPB
Propellant Designation	TP-H3340

* Includes inert weight

** Source: Morton Thiokol, percentages are approximate

On-board ordnance to accomplish stage jettison, SRM ignition, and destruct ordnance is included with the launch vehicle. A Thiokol-manufactured Safety and Arm (S&A) device, Model 2134B or similar device, will be installed to control the proper execution of ordnance detonation commands. This model of S&A device has been fully flown or successfully tested 61 times with 100 percent reliability. The destruct device to be employed has an established record of reliability with a basic design which has not changed since the 1960s.

A two-part COMET Freeflyer is proposed to be launched on the Conestoga launch vehicle from NASA Wallops Flight Facility in Virginia. The COMET Freeflyer consists of a Service Module (SM) and Recovery System (RS). The 1800 lb (818 kg) Freeflyer will be placed into a 300 nautical mile (nm) (± 50 nm) circular orbit. The SM can accommodate payloads weighing approximately 150 lbs (68.2 kg) and the RS can contain approximately 300 lbs (136 kg) of payload. Attitude control will be maintained using small gaseous nitrogen (GN2) thrusters.

During the mission, command uplink and data downlink telemetry will be managed through a Commercial Payload Operations Control Center (COMPOCC) near Houston, Texas. A timeline of planned COMET events will control the prelaunch, launch/ascent, orbit, and deorbit through landing/recovery.

2.1.2 Vehicle Processing and Launch Operations

The Conestoga launch vehicle has undergone system analysis to determine the appropriate vehicle configuration, flight performance evaluations, loads/dynamics/structural analysis, propulsion/ordnance reviews, avionics reviews for electrical circuit design and flight software, and overall assessment of scheduled launch operations. The COMET program has utilized standard evaluation processes through Preliminary Design Reviews (PDR) and Critical Design Reviews (CDR) to develop a safe and reliable launch vehicle capable of achieving the orbital payload goals. To provide a clearer understanding of the actual on-site efforts which will occur at Wallops Island associated with the Conestoga/COMET program, presented below is a general description of the operations.

EER Systems, Corp. has established a Quality Assurance (QA) Plan to follow as materials are received at Wallops Flight Facility. The purpose of this plan is to ensure the integrity of the delivered hardware, assure compliance with engineering drawings, document compliance with applicable safety requirements, and provide a written history that assembly, integration, and test procedures have been approved and followed. The QA Plan will record discrepant conditions and test failures and document witnessing of on-site repairs and hardware removals or replacements. The QA Plan and performance assurance specifications have been designed to meet similar NASA requirements.

Where no Conestoga/COMET program specification is established, the applicable NASA standard specification will apply. The Conestoga/COMET program has been and continues to be coordinated with GSFC Environmental Staff, Range Safety personnel, and the GSFC Project Engineer. System safety requirements established by GSFC documents are addressed in hardware/software design and will be complied with through launch site operations/procedures.

The SRMs like the CASTOR and STAR 48V will arrive by truck to Wallops Island. All SRMs and ordnance will be contained in buildings which have been designated for such storage based upon NASA-derived Quantity Distance (QD) calculations for Wallops Island. The SRMs will be checked upon arriving at GSFC/WFF. Once inspected and ready for assembly, the SRMs will be hoisted into vertical position for launch vehicle assembly at the launch pad. Operational safety requirements have established that on-site movement of any stage transportation on flat bed vehicles will not exceed ten miles per hour. During hoisting operations, all SRM nozzles will be protected.

2.1.3 Payload Description

The Conestoga launch vehicle system is designed to carry a variety of payload modules. Each payload module is designed to minimize pre-launch processing of experiments at the launch facility. Limited amounts of chemicals that will be necessary to process the payloads will be identified in advance by the chemical species and amounts to ensure that regulatory thresholds which require reporting or permitting are not exceeded. No exotic species,

infectious agents, or radiological materials will be part of the experimental payloads.

COMET payloads are sponsored, designed, and developed by NASA's Centers for Commercial Development of Space (CCDS) and their industrial partners. The CCDS's are nonprofit consortia of industry, university and government that conduct space based, high technology research and development in specific areas ranging from materials processing to remote sensing. Each center operates in compliance with established industry and government regulations regarding research and experimentation.

Experiments are regulated by and comply with National Institutes of Health (NIH) guidelines and applicable OSHA standards. Animal experiments are performed in compliance with NASA regulations expressed in 14 Code of Federal Regulations (CFR), Subpart 1232.

COMET payloads are selected in accordance with the objectives of the various CCDSs. These objectives and associated categories of COMET payloads are:

- Space systems for automation and robotics, rendezvous and docking.
- Remote sensing from space, mapping and information systems.
- Controlled ecological life support systems, biomedical, physiological, cell research, and plant and animal experiments.
- Commercial crystal growth for proteins, pharmaceuticals, electronics, and optics.
- Materials development and research; organic and inorganic crystals or thin films, surface coatings, and electrodeposition.
- "Containerless" processing, directional solidification, casting, sintering, and cold welding.
- Multi-phase materials processing research in the areas of catalysts, metals, ceramics, polymers, and electronic and optical materials.

- Space power experiments (non-nuclear), batteries, heat pipes, microwave power transmission, and Rankine cycle power.
- Space based communications and hybrid networks integrating terrestrial and extra-terrestrial communications technologies.
- Space propulsion experiments (non-nuclear).

2.2 PROJECT ALTERNATIVE

EER Systems Corp. investigated alternative launch sites for the Conestoga/COMET program. A review was performed by EER Systems Corp. to identify, define, and select the most technically qualified and cost effective site for launching COMET missions on the Conestoga launch vehicle. This review was based upon the needs of the range users (i.e., experimenters, service module, recovery system, and launch vehicle), launch operations site requirements, and overall objectives for optimal site selection. After initial review, CCAFS and GSFC/WFF were determined to be the only two sites which met the minimum launch requirements and objectives. The criteria for which the sites were evaluated included: access roads, ground communications network, utilities, command and control centers, ground support equipment, launch pad capabilities and capacities, vehicle integration/test and payload processing facilities, workspace, contamination-free space, storage, abilities to safely handle propulsion systems and pyrotechnic devices, range support and clearance, tracking capabilities, weather monitoring, real time displays, security, and fire and medical services. Other factors considered were the overall objectives that include schedule impacts and level of control exerted by the site on operation activities.

The review addressed each requirement and provided a detailed description of each site's capability to support this requirement. An evaluation of each site identifying specific COMET missions objectives versus level of support capabilities was also covered in detail. Based on these site specific comparisons, conclusions were developed and recommendations were made for selecting the most suitable launch site for the Conestoga/COMET mission.

Although CCAFS and GSFC/WWF both provide highly effective levels of support for the Conestoga/COMET mission, GSFC/WFF better supported three major critical mission requirements for this commercial program. These requirements are as follows:

- GSFC/WFF is not a DOD facility like the CCAFS. The Conestoga/COMET program will have a higher degree of schedule flexibility and priority status than if launched from the CCAFS. Programs which are used extensively for DOD missions such as the Shuttle, Delta, Titan, or Atlas programs would always have priority over the commercial Conestoga/COMET program in all areas of range and launch support. Extensive delays based on these other programs could easily affect mission success.
- Launching from GSFC/WFF will maximize the number of passes over the recovery area for access command/data transmission and reentry control without introducing a payload weight penalty.
- Launching the Conestoga/COMET from GSFC/WFF would support the 40° $\pm$ 2° low earth orbit with minimal inclination change minimizing energy expended increasing vehicle performance.

In summary, while both CCAFS and GSFC/WFF have technical launch and support capabilities, Conestoga/COMET-specific requirements would be better met at GSFC/WFF.

2.3 NO ACTION

The No Action alternative would be to not launch the Conestoga. This alternative would impede the progress of the commercial space industry in the United States. The proposed Conestoga/COMET program has been developed to serve a recognized demand for commercial launch vehicle service within the United States. The No Action alternative could result in the loss of research and development technology to foreign space programs which compete with United States-based space programs. Successful research experiences with NASA and foreign space missions have identified the technical feasibility of using

spacecraft to achieve zero and microgravity conditions necessary for high technology projects not obtainable under normal atmospheric conditions. The No Action alternative would eliminate the improved launch schedule flexibility to be provided by the Conestoga.

Public Law 98-575, known as the "Commercial Space Launch Act," was enacted on October 30, 1984. This legislation established that it was in the national interest to develop commercial launch vehicles. It was recognized that foreign development into commercial launch vehicles was in progress and that dependance on such service would be an economic and technological loss to the United States. In supporting development of a U.S. commercial launch vehicle, Congress specified that launches conducted by private enterprise "are in the interest of public health and safety, national security, and foreign policy considerations of the U.S." (Ref. 20).

In consideration of the initial private venture benefits from high technology space experimentation, commercial investment in lieu of solely federal development of space technology and launch capability has been recognized in the legislative act as appropriate. The alternatives of limiting commercial space programs with reliance on federal programs for commercial research and development or foreign competition for similar space support has been determined as not within the national interests (Public Law 98-575). Consequently, the No Action alternative is not deemed to be a reasonable alternative.

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The GSFC/WFF is located in Accomack County on the Eastern Shore of Virginia. GSFC/WFF is approximately 35 miles (56 km) south of Salisbury, Maryland and 90 miles (145 km) north of the Hampton Roads, Virginia area. Figure 2 provides a general location for the project area. The GSFC/WFF is composed of three separate areas: the main base, the mainland, and Wallops Island. The main base has approximately 2,230 acres (900 ha) of land which supports the main administrative buildings, research buildings, aircraft landing strip, and hangar areas. The main base is located along State Roads 175 and 798. Five miles (8 km) east of the main base is the town of Chincoteague. The main base is separated from Chincoteague by an extensive salt water marsh system. The "mainland" area is a small area of approximately 100 acres (40 ha) due west of Wallops Island with minimal facilities. The mainland property is surrounded by farmland on three sides with a salt water marsh and Intracoastal Waterway separating it from Wallops Island to the east. Wallops Island covers approximately 4,200 acres (1,700 ha) with a length of approximately seven miles (11 km) and width of one-half mile (0.8 km). The Atlantic Ocean borders its eastern shore with Chincoteague Inlet to the north. Wallops Island is contiguous with Assawoman Island to the south. Prior to 1986, these two islands were separated by an inlet. Assawoman Island, like Assateague to the northeast, has important resource value by providing extensive undeveloped wildlife habitat in both estuarine and upland areas. Both Assawoman and Assateague Islands are federally owned.

The 100-year floodplain and 500-year floodplain for Wallops Island occur at 9.0 feet (2.7 m) and 10.5 feet (3.2 m) above sea level, respectively (Ref. 21). The entire Wallops Island is within both floodplain limits. The proposed Conestoga/COMET project will utilize existing buildings and roadways at Wallops Island without additional impacts to floodplains and therefore floodplain impacts are not discussed in this EA. Since GSFC/WFF launch pads are located only on Wallops Island, there is no pad alternative for the Conestoga launch at GSFC/WFF. The siting of the existing launch pads on Wallops Island versus the main base was necessary to separate the launch

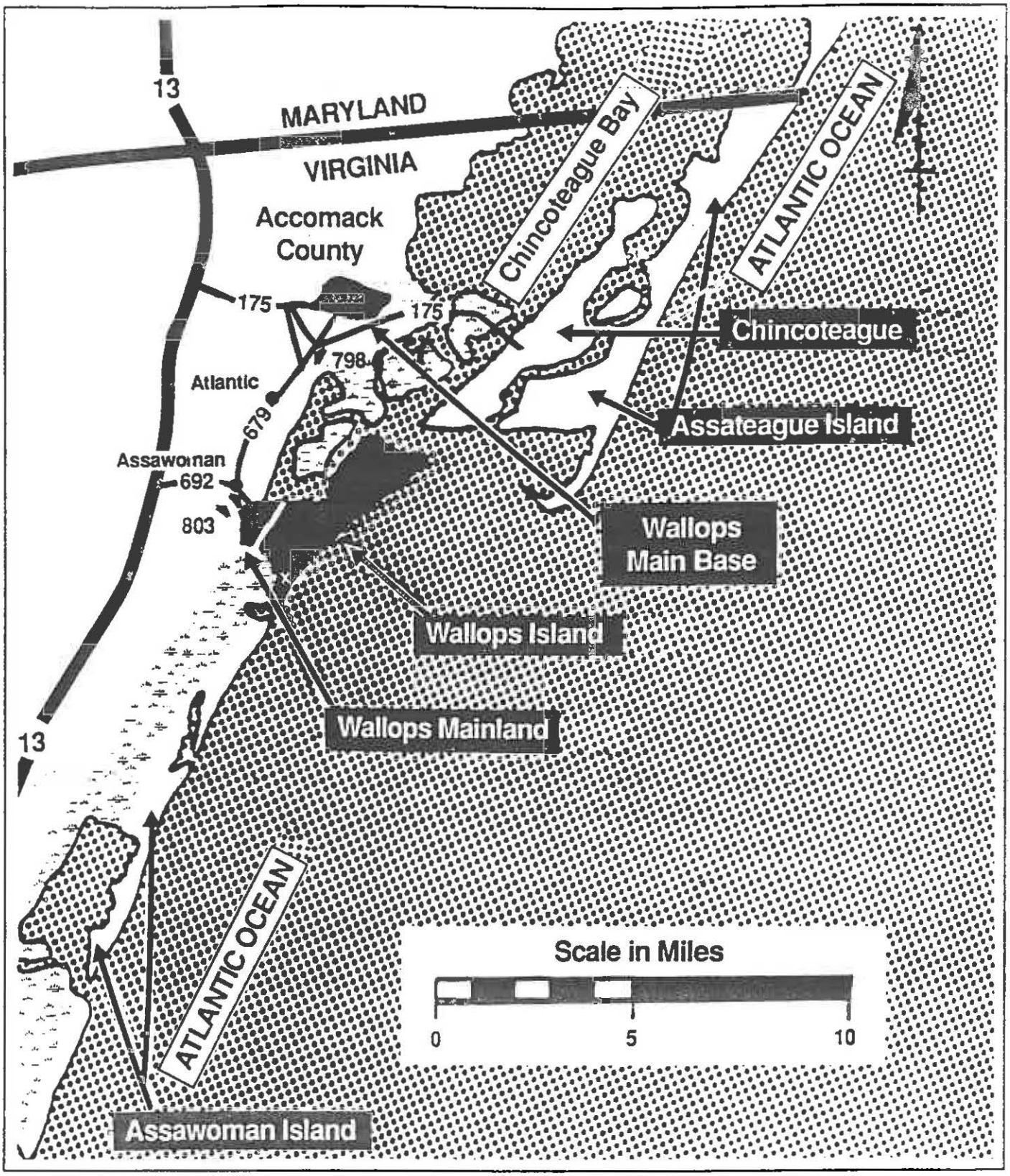

Figure 2
Relative Locations of Wallops Main Base, Wallops Mainland, and Wallops Island

Source: Reynolds, Smith and Hills, Inc., 1992

Legend
x - Launch Pad
(approximate location)

complexes from more densely developed lands and to avoid rocket launches over populated areas.

A letter from the State Historical Preservation Office (SHPO) states that the proposed project will not likely impact resources under their purview and assessment of impacts to these resources in this EA is not warranted. A copy of the SHPO's response to the proposed project is in Appendix 1.0.

3.1 AIR QUALITY

The ambient air quality in Accomack County is considered excellent (Ref. 21). Accomack County is in an attainment area for all state and federal air quality standards (Commonwealth of Virginia State Air Pollution Control Board Regulations for the Control and Abatement of Air Pollution, January 1, 1992). Being within an attainment area, GSFC/WFF meets the National Ambient Air Quality Standards (NAAQS) for the six primary pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, sulphur dioxide, particulate matter (total suspended particulate), and particulate matter less than 10 microns [PM10]). The NAAQS are listed in Table 3-1. The Commonwealth of Virginia has not conducted any air quality monitoring in Accomack County.

The potential for a change in status to non-attainment is not anticipated based upon the lack of regional heavy industry which would provide sources for air quality degradation. Accomack County is not one of the areas designated by EPA as "Air Quality Maintenance Area" which is defined as any area which, due to air quality or projected growth rate, may have the potential for exceeding any ambient air quality standards within a subsequent ten-year period (Ref. 34). The lack of large urban and industrial areas within Accomack County helps to maintain air quality below the NAAQS.

The general meteorological conditions at GSFC/WFF are presented in Table 3-2 and the major sources and types of air emissions emitted at GSFC/WFF are presented in Table 3-3. These two tables were developed from information included in Chapter 2 of the "Air Resources" of the Environmental Resources Document (ERD) for GSFC/WFF (Ref. 21). The ERD for GSFC/WFF indicates that the emissions of the major sources are relatively small, highly localized,

Table 3-1. National Ambient Air Quality Standards

Parameter	Averaging Time	Units	Standard	
			Primary	Secondary
TSP	Annual Geometric Mean	ug/m^3	75	60
	Maximum 24-hour Concentration*	ug/m^3	260	150
PM10	Annual Arithmetic Mean	ug/m^3	50	50
	24-hour Average Concentration	ug/m^3	150	150
SO_2	Annual Arithmetic Mean	ug/m^3	80	--
		ppm	0.03	--
	Maximum 24-hour Average*	ug/m^3	365	--
		ppm	0.14	--
	Maximum 3-hour Average*	ug/m^3	--	1,300
		ppm	--	0.50
O_3	Maximum 1-hour Concentration	ug/m^3	235	235
		ppm	0.12	0.12
CO	Maximum 8-hour Average*	mg/m^3	10	10
		ppm	9	9
	Maximum 1-hour Concentration*	mg/m^3	40	40
		ppm	35	35
NO_2	Annual Arithmetic Mean	ug/m^3	100	100
		ppm	0.05	0.05
Pb	Maximum Arithmetic Mean Averaged Over a Calendar Quarter	ug/m^3	1.5	1.5

*Maximum concentrations not to be exceeded more than once a year at any location.

Legend:

TSP	Total Suspended Particulates
PM10	Particulate Matter < 10 microns
SO_2	Sulfur Dioxide
NO_2	Nitrogen Dioxide
ppm	Parts per million
ug/m^3	Micrograms/Cubic Meter
mg/m^3	Milligrams/Cubic Meter
CO	Carbon Monoxide
O_3	Ozone
Pb	Lead

Source: Commonwealth of Virginia, State Air Pollution Control Board, Regulations for the Control and Abatement of Air Pollution, January 1, 1992.

Table 3-2. General Meterological Conditions at GSFC/WFF

Climatic Region
Humid Continental Warm Summer Climate Zone

Temperatures
Coldest Month - January (mean low of 27.8°F)
Warmest Month - July (mean high of 83.3°F)

Precipitation
Annual precipitation 109 centimeters (evenly distributed throughout the year)

Wind Conditions
Wind speed and direction variable, correlated with month and local conditions.

Direction (Relative Frequency [%])	
South (20)	Northeast (12)
Northwest (17)	North (11)
West (13)	Southeast (8)
Southwest (12)	East (7)

Mean wind speed greatest in February and March.
Mean wind speed lowest in July and August.

Sea Breezes - June through August, South to Southeast winds, averaging 12 knots.

Source: Environmental Resources Document - Wallops Flight Facility, Wallops Island, Virginia, NASA Technical Memorandum 10074, 1990.

Table 3-3. Major Sources and Types of Air Emissions Emitted at GSFC/WFF

Source	Air Emissions
Central Boiler Plant	Hydrocarbons
Rocket Launches/Propellant Burning	Carbon Monoxide Carbon Dioxide Water Nitrogen Hydrogen Hydrogen Chloride Aluminum oxide Lead
Aircraft Operations	Hydrocarbons
Automobile/Truck Traffic	Hydrocarbons

Source: Environmental Resources Document - Wallops Flight Facility, Wallops Island, Virginia, NASA Technical Memorandum 10074, 1990.

readily dispersed in the atmosphere, and/or occur infrequently. Therefore, the emissions have no long-term impact on air quality.

3.2 NOISE

The areas surrounding the GSFC/WFF launch range include the Atlantic Ocean to the southeast, and a salt marsh is to the west. The mainland is approximately 1.7 mi (2.8 km) northwest of the proposed launch pad. The upland areas west of the marsh are predominately agricultural land. The closest towns include Atlantic and Chincoteague which are 4.4 mi (7.1 km) north/northwest and 7.0 mi (11.3 km) northeast respectively, from the proposed launch pad. Assawoman, the closest farming community, is 3.3 mi (5.3 km) to the northwest. Assawoman Island is 1.6 mi (2.6 km) to the southwest and Assateague Island is 7.0 mi (11.2 km) to the northeast. The closest noise-sensitive site, a single-family residence, occurs 2.0 mi (3.3 km) to the west. Noise-sensitive sites include exterior areas of frequent use; residences, parks, schools, hospitals, churches and other places where quiet is important for normal activities.

The noise sources within 5.0 mi (8 km) of the proposed launch site include: 1) automobile and truck traffic along Routes 803, 692, 679, 175 and 13; 2) aircraft activities (i.e., flyovers of jets, helicopters and propeller-driven aircraft), including those from GSFC/WFF Research Airport; 3) tractor and other noises associated with agricultural activities which occur year-round in the farmland adjacent to Wallops Island; 4) typical community noises (e.g., lawn mowers, emergency/voluntary fire department sirens and barking dogs); 5) noise resulting from high winds and wave action along the Atlantic shoreline; 6) boat engine noises; and 7) occasional rocket launches at GSFC/WFF Launch Range. Based on the site reviews conducted for this EA, road traffic noise is the predominant noise source. Except for isolated farm houses, most of the residences in the project vicinity are situated next to a road. Noise from aircraft flyovers and noise from rocket launches are considered minor, intermittent sources.

Rocket noise has been part of the ambient noise levels over the last 46 years (Ref. 21). The primary noise source from rocket launches is from the motor exhaust flow. Noise "sound" from the exhaust flow is generated by the

fluctuating pressures accompanying the mixing of the ambient atmosphere with the hot, high velocity rocket exhaust. The fluctuating pressures cause the surrounding air particles to vibrate, producing a sound wave. The sound is radiated in all directions from the exhaust flow; however, the magnitude of the sound level is highly directional (Ref. 23). The maximum angle of maximum sound radiation is approximately 50 to 70 degrees from the axis of the exhaust flow (Ref. 7). The noise and frequency spectrum generated are determined by the thrust of the rocket motors and the distance from the motors (Refs. 16, 20).

3.3 WATER QUALITY

The surface water in the vicinity of Wallops Island is comprised of shallow estuarine areas which are designated as Class II surface waters by the State of Virginia. The Atlantic Ocean east of the island is designated as Class I waters by the state. These classifications specify water quality standards for dissolved oxygen (DO), pH, and maximum temperature.

GSFC/WFF has been cited by the State Water Control Board (SWCB) for permit noncompliance of its Virginia Pollutant Discharge Elimination System (VPDES) permit due to the wastewater treatment operations on Wallops Island. Hog Creek is a receiving estuary for treated wastewater from Wallops Island and was noted by the SWCB as an existing or potential area of water pollution. In order to achieve compliance, GSFC/WFF is installing a force main to transfer wastewater to the main base for treatment and thus eliminate the point source discharge to Hog Creek.

Groundwater resources provide potable drinking water for GSFC/WFF. Two water supply wells located on the mainland property of GSFC/WFF provide drinking water supplies for Wallops Island. The geologic profiles and recharge data are provided in Chapter 3 of the ERD (Ref. 21). The ERD and SWCB 1987 "Eastern Shore Water Supply Plan" state that adequate groundwater supplies of good quality water exist in the aquifers tapped by GSFC/WFF. Although a cone of depression in the groundwater table has occurred in the Chincoteague--GSFC/WFF area, the SWCB has not observed evidence of significant saltwater intrusion in Accomack County.

3.4 FLORAL AND FAUNAL COMMUNITIES

The immediate vicinity of the COMET pad is characterized by a dune meadow-thicket mosaic. The dune meadow portion is dominated by various hardy grasses and herbs such as salt meadow cordgrass (Spartina patens), broomsedge (Andropogon glomeratus), seaside goldenrod (Solidago sempervirins) and various panic grasses (Panicum spp). The thicket community type is dominated by bayberries (Myrica cerifera and M. pensylvanica), salt bush (Baccharis halimifolia) and sumac (Rhus copallina) with an occasional red cedar (Juniperus virginiana). An active dredge material disposal site, operated by the Army Corps of Engineers, is located south of the proposed launch pad site. To the east, the beach is partially stabilized with riprap and a low primary dune dominated by American dunegrass (Ammophila breviligulata) and saltmeadow cordgrass exists. To the south and west, the thicket community grades to the maintained areas adjacent to the Z-40 Terminal Building and a paved arterial road, respectively. West of the paved road the elevation decreases until the tidal marsh is reached approximately 0.2 mi (0.3 km) from the proposed launch site. The marsh fringe is dominated by woody species such as marsh elder (Iva frutescens) and salt bush which grades to high marsh grasses dominated by salt grass (Distichlis spicata) and saltmeadow cordgrass. Smooth cordgrass (Spartina alterniflora) is the dominant species of the lower salt marsh.

Fauna expected to utilize the habitat types encountered in the vicinity of the proposed launch site have been discussed in the ERD for GSFC/WFF (Ref. 21). An inspection of the area was conducted by the author on a clear, cold, extremely windy day in December 1991. The conditions were not prime for wildlife observation and many species undoubtedly had taken shelter. Deer (Odocoileus virginianus) and raccoon (Procyon lotor) tracks as well as rabbit (Sylvilagus floridanus) scat was observed throughout the area. Ghost crab (Ocypode quadrata) burrows were seen in the upper beach, dune, and dune meadow. Yellow-rumped warblers (Dendroica coronata) and northern cardinals (Cardinalis) were common to the thicket zone. A Great Blue Heron (Ardea herodias) was observed in the tidal marsh. Songbird nesting is expected in the thicket zone; however, no nests were observed.

Approximately 15 species of shore birds utilize Wallops Island during spring and fall migration (Ref. 21). Piping plover (Charádrius melódus) which is listed as threatened by both the U.S. Fish and Wildlife Service (USFWS) and the Virginia Department of Game and Inland Fisheries (VDGIF) and Wilson's plovers (C. wilsónia; endangered, VDGIF) presently use the south end of Wallops Island for nesting. This nesting area is a minimum of 0.9 mi (1.4 km) from the proposed launch site complex. Piping plover nesting has also been documented on the north end of Wallops Island (Ref. 21). Additionally, a colony of four tern species (royal tern, Sterna maxima; sandwich tern, S. sandvicensis; common tern, S. hirúndo; gull-billed tern, S. nilótica), and black skimmers (Rynchops nigra) utilize a new island off the northern section of Wallops Island for breeding. The gull-billed tern is listed as threatened by the VDGIF and may soon be proposed for federal listing. The sandwich tern is presently classified as recommended special concern by the VDGIF and not formally listed as threatened or endangered.

The natural environment in the vicinity of the proposed COMET pad has been highly impacted by human activity. Trail roads crisscross the site. In addition to the pad area, debris is scattered about the area. The dredge material disposal area to the south appeared to have recently been constructed. The primary dune was topped by a storm surge during the latter part of October 1991, and again in January 1992. A dual-celled sewage treatment pond is located approximately 0.2 mi (0.4 km) west of the pad complex across the previously mentioned paved road.

3.5 THREATENED AND ENDANGERED SPECIES

The following federally listed species may inhabit or occur in the project area:

Birds

Peregrine falcon

Bald eagle

Piping plover

Reptiles
Atlantic green sea turtle
Loggerhead sea turtle
Kemp's Ridley sea turtle
Hawksbill sea turtle
Leatherback sea turtle
Mammals
Finback Whales
Sei Whales
Humpback Whales
Right Whales
Sperm Whales

General descriptions of these species are presented in Chapter 6 of the ERD (Ref. 20).

Bald eagles normally lay their eggs in large live trees near open water in the Wallops area between mid-January and March. A single clutch of one to three eggs are laid with incubation requiring 34 to 38 days. The young fledge at nine to 14 weeks. A second clutch of eggs will be laid if the first is destroyed. No critical habitat for the bald eagle has been designated in the Wallops Island area. Piping plover nest construction is on the upper beach near the dunes and other open sandy areas with little vegetation. The nest consists of a slight depression often lined with broken shell. Nests are located 100 to 200 feet (30 to 60 m) apart. Usually four eggs are laid from the end of April to the beginning of July. Incubation takes roughly 28 days. Presently, no critical habitat for the piping plover has been designated in the vicinity of Wallops Island.

There are five sea turtle species whose range includes the project area: Hawksbill (endangered), Kemp's ridley (endangered), Leatherback (endangered), Loggerhead (threatened), and Atlantic green (threatened). All the above-mentioned marine turtles have been documented in Accomack County; however, none are known to breed or nest as far north as Virginia (Ref. 3). Juveniles and adults are occasionally observed in the waters off Wallops Island (Ref. 21). Loggerhead sea turtles have historically nested intermittently on the

island and a crawl was observed in 1990, but no egg laying occurred (Ref. 11). No critical habitat has been designated for any of these species in the vicinity of Wallops Island.

There are five federally listed marine mammal species whose range includes the project area: Finback, Sei, Humpback, Right, and Sperm Whales. All of these species are listed as endangered. All of these marine mammals occasionally inhabit the deep waters adjacent to Wallops Island. No critical habitat for these species has been designated in the vicinity of Wallops Island (Ref. 21).

3.6 HEALTH AND SAFETY

The GSFC/WFF has an on-site Health Unit to provide medical services for minor emergencies and to stabilize accident victims for transport. A physician is under contract to provide medical care on a part-time basis. GSFC/WFF does have two fully operational Fire Stations designated #1 and #2 for the main base and Wallops Island, respectively. The two fire stations have the following response equipment:

	Pumper	Tanker	Crash Truck	Ambulance	Rescue	Other
Fire Station #1 (Main Base)	1		4	1		2
Fire Station #2 (Wallops Island)	2	-	1	1	-	-

The emergency response teams have been trained in emergency first aid, crash, fire and rescue, and hazardous materials response. Under most conditions, the GSFC/WFF Fire Department is able to adequately respond to an emergency situation. However, GSFC/WFF has entered into a mutual aid agreement with 13 volunteer fire companies in Accomack County and five companies in Northampton County. The rescue units in Cape Charles, New Church and Atlantic District have also agreed to respond if a significant disaster occurred requiring their support. Initial additional requests from GSFC/WFF to respond to an emergency would be handled by the closest volunteer companies in the nearby towns of Atlantic and Chincoteague. The volunteer companies in those areas and other nearby towns can provide the following equipment:

Company - #	Pumper	Tanker	Ambulance	Rescue	Other
Atlantic (#4)	2	1	-	1	-
Chincoteague (#3)	4	-	2	-	1
New Church (#1)	1	2	-	1	-
Greenbackville (#2)	1			-	-
Saxis (#5)	2	1		-	-

Source: (Paul, 1990)

Two major hospitals are approximately 40 miles away from GSFC/WFF (Ref. 21). Peninsula General Hospital Medical Center is located across the state line in Salisbury, Maryland. This facility is a regional shock-trauma center with 383 beds, fully equipped emergency rooms and a helicopter pad. Peninsula General Hospital holds disaster drills four times a year and is designed through personnel training and available equipment to provide disaster response. The second major hospital, Northampton-Accomack Memorial Hospital is located in Nassawadox, Virginia. Northampton-Accomack Memorial Hospital has 145 beds with fully equipped emergency rooms. This hospital would provide back-up support to Peninsula General Hospital in the case of a large-scale disaster. A third small hospital, McCready Hospital, is located 35 miles from GSFC/WFF in Crisfield, Maryland.

The GSFC has prepared an emergency contingency plan which is designed "to minimize hazards to human health or the environment from fires, explosions, or any unplanned sudden or non-sudden releases of hazardous waste or hazardous waste constituents to the air, soil, ground water, or surface water" (Ref. 9). This plan designates primary and alternate Emergency Coordinators who are to be notified in the case of emergencies with potential hazardous substances involved. The plan also lists entities to be contacted when off-site notification is warranted. The plan outlines step-by-step emergency response procedures to be followed to determine if hazardous contamination exists at an emergency site. The plan presents control and prevention procedures as well as post-emergency provisions regarding follow up to an emergency response.

The GSFC has a full-time, 24-hour security force which serves both the Main Base and the Wallops Island area. GSFC/WFF is a controlled access facility

with perimeter fencing. Normal access to the facility is achieved through manned security stations which badge and log visitors to the facility. Employees of the facility are also badged. The GSFC/WFF security force performs security patrols, building security checks, personnel identification, and carries on normal police duties on GSFC/WFF grounds. Areas surrounding GSFC/WFF properties are patrolled by the Accomack County Sheriff's Department. Approximately 20 officers provide police service for the Sheriff's Department. The closest Virginia State Police Department is in Melfa, Virginia.

3.7 TOXIC SUBSTANCES

The Health, Safety and Security Office at GSFC maintains a list of toxic substances used at the facility. Chapter Nine of the ERD discusses the presence of toxic substances at GSFC which are regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Toxic Substances Control Act (TSCA) also requires EPA to regulate such chemical substances that present risk of injury to health and the environment. The applicability of TSCA at GSFC is generally limited to asbestos-containing materials and the potential presence of polychlorinated biphenyls in on-site transformers. Due to the presence of asbestos in many of the buildings at GSFC/WFF, the facility has an in-house State of Virginia licensed asbestos contractor to remove small quantities of asbestos encountered during normal maintenance work. Large asbestos removal projects are contracted out. Any decommissioning or decontamination of PCB-contaminated transformers would have to comply with TSCA regulations.

3.8 SOLID AND HAZARDOUS WASTES

Solid waste (SW) and hazardous waste (HW) management at GSFC/WFF is described in the 1990 GSFC/WFF ERD (Ref. 21). SW and HW disposal at the facility is carried out in accordance with the Environmental Protection Agency (EPA) and Virginia Department of Waste Management (VDWM) regulations.

A contractor to GSFC disposes of SW at the Accomack County Landfill, near Atlantic, Virginia. GSFC operates a "less than 90-day" HW accumulation area under EPA Identification Number VA 8800010763. The VDWM requires a separate EPA Identification Number, VA 7800020888, for HW generated on Wallops Island.

GSFC HW technicians are responsible for HW management until it is collected by an HW broker for proper disposal.

3.9 ECONOMIC ENVIRONMENT

The GSFC/WFF is one of the largest employers in the Eastern Shore of Virginia. Located in a sparsely populated, rural area of Virginia, the approximate annual budget of the facility, at $87 million (FY90) has a major impact to the local economy. Descriptions of the employee salary structure, civil service versus contractor distribution figures, and surrounding county employment distribution is presented in Chapter 14 of the ERD. GSFC/WFF is the third largest single employer in Accomack County (Ref. 21). The first and second largest employers in Accomack County are poultry processors, Perdue Foods and Tyson Foods, respectively.

Extensive agricultural lands surround GSFC/WFF. Farming, commercial fishing, and seasonal tourism are the other major industries impacting the area. Staple farm goods for the area include potatoes and soy beans. Numerous fishing boats and seafood processing facilities are located in nearby Chincoteague. The Chincoteague National Wildlife Refuge and Assateague Island National Seashore attract visitors nationwide to observe their protected natural resources. To support these visitors, the Chincoteague area has been developed with motels, restaurants, cabins and other tourist-associated accommodations which provide beneficial economic impacts to the area.

3.10 LAND USE

The Accomack County Comprehensive Plan has been developed to guide future social, economic, and physical development in Accomack County. This plan was developed by the Accomack County Planning Commission with local plan implementation through the Accomack County Department of Environmental Affairs. The Department of Environmental Affairs is charged with administering zoning and subdivision ordinances.

The Accomack County Comprehensive Plan has listed key issues which are the major concerns to future development in the county. These issues are ground water, waterfront development, residential development, orderly design of subdivisions, and safety and continued level of service (LOS) of US Route 13.

Surrounding land use to Wallops Island is predominantly agricultural. Crops and poultry are the major agricultural operations in Accomack County. Commercial seafood, tourism, and land conservation predominate land use in the Chincoteague/Assateague area northeast of Wallops Island.

4.0 ENVIRONMENTAL IMPACT OF THE PROPOSED ACTIONS AND ALTERNATIVES

4.1 AIR QUALITY

The primary source of air emissions from the launch of the Conestoga launch vehicle will be from the combustion of the hydroxyl terminated polybutadiene (HTPB) formulated propellant used in the SRMs. HTPB propellants consist primarily of ammonium perchlorate, aluminum, HTPB, iron oxide, isophorone diisocyanate, and dioctyl adipate (Ref. 18). The chemical emissions from the combustion of HTPB propellants are listed in Table 4-1.

Table 4-1 HTPB Emission Components

Compound	Percent by Weight
Aluminum Oxide	36.0%
Carbon Monoxide	21.0%
Carbon Dioxide	2.5%
Hydrogen Chloride	21.0%
Water	8.5%
Nitrogen	8.5%
Hydrogen	2.0%
Other	1.0%

Source: Final Environmental Impact Statement Space Shuttle Advanced Solid Rocket Motor Program. Stennis Space Center, 1989.

Of the exhaust emissions, hydrogen chloride, carbon monoxide, and aluminum oxide are considered the primary air pollutants of concern near the launch pad. In high concentrations, hydrogen chloride and carbon monoxide can be potentially hazardous (Ref. 17). The short-exposure limits for these pollutants are listed in Table 4-2.

The air pollutants resulting from the launch of the Conestoga launch vehicle will be dispersed over a large area within a short timeframe (i.e., less than ten minutes, which is the estimated burn time of the rocket motors). The initial velocity of the rocket is estimated to be 1,200 feet per second (ft/sec) (370 meters per second [m/sec]) increasing to 3,200 ft/sec (975 m/sec) after 60 seconds and to 13,000 ft/sec (4,000 m/sec) after 120 seconds.

Table 4.2 Air Quality Guidelines for Short-Term Exposure to Rocket Exhaust (In ppm)

Product	10 min	30 min	60 min	1 hr/day	5 hr/day, 3-4 days/mo
Hydrogen chloride					
STPL -TWA	4	2	2	2	0.7
-CL	8	4	4	4	
PEL -TWA	7	3	3		
-CL	14	6	6		
EEL -TWA	100	50	20		
Carbon Monoxide					
STPL -TWA	50	35	25		15
-CL	135	53	38		
PEL -TWA	275	100	60		
-CL	275	100	60		
EEL -TWA	1,500	800	400		
Nitrogen Oxides					
STPL -TWA	1	1	1	1	0.5
-CL	1	1	1		
PEL -TWA	3	3	2		
-CL	3	3	2		
EEL -TWA	30	20	10		

Product	Type of Limit	Duration	TWA, mg/m^3	CL, mg/m^3
Particulate (Aluminum oxide)	National primary standards	Annual geometric mean	0.075	0.26*
	National secondary standards	Annual geometric mean	0.06	0.15*

*Maximum 24-hour concentration, not to be exceeded more than once a year.

Abbreviations: TWA = Time Weighted Average
CL = Ceiling Limits
STPL = Short-Term Public Limits
PEL = Public Emergency Limits
EEL = Emergency Exposure Limits (Occupational)

Source: OCST, 1986.

Therefore, after 30 seconds after ignition, the launch vehicle is anticipated to have an altitude of approximately 4 mi (6 km). After ten minutes, the launch vehicle will have an altitude of approximately 300 nautical miles (nm) (550 km) and will be 1,240 nm (2,000 km) downrange.

Due to the velocity of the rocket during the launch, concentration of air pollutants resulting from the launch of the Conestoga will vary along the vehicle trajectory that will be primarily over the Atlantic Ocean. The concentrations of pollutants will be the greatest during lift-off and decrease continuously as the vehicle accelerates. Therefore, the highest concentration of potentially harmful air emissions will occur in the area surrounding the launch pad, an area that no one would be allowed near during lift-off. The concentration of these air emissions will be dependent upon the distance from the launch pad and the rate of dispersion which is influenced by local meteorological conditions.

The assessment of air quality impacts from the launch of the Conestoga vehicle from the GSFC/WFF Launch Range focuses on the offsite "uncontrolled" areas. Assawoman Island, which is located 1.6 mi (2.6 km) southwest of the proposed COMET launch pad, is the closest offsite area. The closest area where the general population could potentially be effected would be the upland/mainland area located 1.7 mi (2.8 km) northwest of the proposed COMET launch pad.

Concentrations of air pollutants from rocket launches are typically determined by dispersion modeling. For this assessment of the Conestoga launch vehicle, the results of the dispersion modeling conducted for the Programmatic EA was used (Ref. 20). The Programmatic EA for the commercial launch vehicle program presented peak concentrations of hydrogen chloride, carbon monoxide, and aluminum oxide for three meteorological conditions (sea breeze, spring, and fall) for the Scout, Delta, Atlas, and Titan rocket launches using NASA/MSFC multilayer atmospheric diffusion model (Ref. 20). Of these rockets, the Delta was considered the most representative of the peak concentrations of air pollutants anticipated from the Conestoga and therefore was used in the analysis of potential air quality impacts.

By using the Delta emissions data, the assessment of the Conestoga effects on air quality represents a worst case scenario since the Delta is a slightly larger launch vehicle. The Delta rocket uses nine solid strap-on motors and a liquid (oxygen/kerosene) propellant core motor. The Conestoga has six solid strap-on motors and a solid propellant core motor. The air emissions from the liquid propellant of the Delta core motor is similar to the solid rocket motors except liquid propellant motors do not emit hydrogen chloride and aluminum oxide (Ref. 1).

To assess potential impacts, peak concentrations were determined for the nearest off-site area, the northern end of Assawoman Island which is 1.6 mi (2.6 km) southwest of the proposed launch pad. The estimated peak downwind concentrations at this distance for hydrogen chloride, carbon monoxide, and aluminum oxide for sea breeze, fall, and spring meteorological conditions are shown in Table 4-3. The concentrations of air pollutants estimated for the northern end of Assawoman Island are considered representative of those levels expected to occur on the upland/mainland area which is located 1.7 mi (2.8 km) northwest of the proposed launch pad. The peak concentrations are anticipated to occur for a short time (less than two minutes) as the exhaust cloud of the combustion product passes over the northern end of Assawoman Island.

Table 4-3. Estimated Peak Concentrations of Hydrogen Chloride, Carbon Monoxide, and Aluminum Oxide from a Conestoga Rocket Launch at the Nearest Off-Site Area, Assawoman Island

Air Pollutant	Meteorological Condition		
	Sea breeze	Fall	Spring
Hydrogen Chloride	0.4 ppm	0.2 ppm	0.2 ppm
Carbon Monoxide	1.7 ppm	0.9 ppm	0.6 ppm
Aluminum Oxide	1.0 mg/m^3	0.6 mg/m^3	0.4 mg/m^3

Source: OCST, 1986.

Comparison of the estimated peak levels anticipated from the launch of the Conestoga launch vehicle to the NAAQS (see Table 3-1) and the short-term

exposure guidelines (see Table 4-2) shows that the levels for hydrogen chloride and carbon monoxide are well below the exposure standards. The estimated peak aluminum oxide level of 1.0 mg/m^3 is anticipated to disperse within minutes and would be well below the standard for the maximum 24-hour average concentration of particulates of 0.26 mg/m^3 (Ref. 20). Based on these comparisons, the launch of the Conestoga launch vehicle will not exceed any of the NAAQS or short-term exposure guidelines; therefore, will not have a significant adverse impact on air quality.

Exhaust emissions into the upper troposphere by ELVs will not result in ground-level effects due to their rapid dilution by turbulent mixing and wind shear which occurs in that layer (Ref. 20). Similarly, upper atmospheric effects from ELV exhausts were evaluated by the Programmatic EA for ELVs. This assessment found no significant impact from water, carbon dioxide, nitrogen oxides, or hydrogen chloride to upper atmospheric ozone concentrations, global radiation balance through absorption or scattering of incoming or outgoing radiation, or impacts to radio wave transmission.

In summary, the exhaust emissions from the Conestoga launch vehicle is anticipated to have a minor short-term affect on ambient air quality. The exhaust emissions will be scattered over a wide area primarily over the Atlantic Ocean away from any population centers where conditions for dispersion are favorable and will not impact the recreational use of Chincoteague National Wildlife Refuge or Assateague Island National Seashore. The exhaust emissions are not anticipated to exceed or contribute to the exceedance of any federal and state air quality standard. Due to the infrequent launches, no long-term or cumulative air quality impacts are anticipated.

4.2 NOISE

The noise generated by the Conestoga launch vehicle during lift-off from the GSFC/WFF Launch Range will be widely distributed along the trajectory which will be primarily over the Atlantic Ocean. The general area in which audible noise will potentially be detectable during the launch of the Conestoga from the GSFC/WFF Launch Range is depicted in Figure 2. The noise generated will

be infrequent and will be heard in the areas surrounding the launch pad for approximately two minutes, the estimated burn time for the first and second stage motors. To evaluate the potential noise impacts associated with the launch of this vehicle from the proposed launch site, the following assessment was performed. The assessment focused on the potential for hearing damage to persons in uncontrolled areas and the potential for off-site structural damage.

Overall sound pressure level (OSPL) was used to describe noise levels in this EA. The term "overall" designates the full-frequency coverage (i.e., 22 to 22,720 hertz (Hz)) which represents the audible range of frequencies. OSPL gives equal weight to all frequencies unlike A-weighted sound levels (DBA), one of the more commonly used noise metrics. The dBA noise metrics are weighted to account for the sensitivity of the human ear to frequencies between 1,000 and 6,000 Hz and their insensitivity to low (less than 1,000 Hz) and high (greater than 6,000 Hz) frequencies. Due to this weighting and the predominately low frequencies (less than 600 Hz) of rocket noise, dBA levels measured for rocket launches are generally 20 decibels (dB) lower than those of the unweighted levels (Ref. 18). In general, the peak acoustical energy from rocket exhaust occurs at low frequencies, 10 to 30 Hz (Ref. 32). These low frequency soundwaves will experience minimal (less than 1 dB) atmospheric attenuation effects, are less harmful to the ear and travel over a greater distance than high frequency soundwaves (Ref. 4). Due to the difference in noise metrics and since structural damage is more likely with low frequencies, the OSPL was considered more appropriate to describe rocket noise than dBA. Subtracting 20 dB from the OSPL presented in this report will give an approximate estimate of the noise in dBA. This would allow for general comparisons to noise levels given in dBA.

Damage risk criteria used in the evaluation of the commercial ELV program to identify noise impacts are listed in Table 4.1 (Ref. 20). These levels represent the threshold levels beyond which hearing and structural damage may occur.

Table 4.1 Noise Levels To Access Damage Risk

Hearing Damage Risk Values (OSPLs)	Damage to Structures Threshold
130 dB, 10 sec.	130 dB (frequencies lower than 37 Hz)
125 dB, 30 sec.	
120 dB, 60 sec.	

NASA and the U.S. Air Force have also used other damage risk criteria in previous studies (Ref. 31). They recommend that for "uncontrolled population" the OSPL is not to exceed 120 dB. This level corresponds to the onset of pressure sensations in the ear and a general feeling of concern. At 140 dB, there will be a painful sensation in the ear. Sound pressure of 160 to 170 dB (rifle shots at close range) may lead to permanent hearing damage after short exposure. In addition, due to the predominately low frequency, general rattling of windows and walls may also be experienced with an OSPL of 120 dB. Structural damage to buildings has been known to occur between 130 and 140 dB for the predominantly low frequency range typical of rocket noise.

Three previous documents (Refs. 16, 20, 21) discuss the impacts of various size rockets on the ambient noise levels. The largest and loudest rocket that has been launched at Wallops Island is a Scout. Based on noise data in the NASA, 1973 EIS an OSPL of 100 dB from Scout launches could extend out approximately 7.5 mi (12 km) from the launch site for a matter of a second or two then rapidly decrease. This distance would include the towns of Atlantic and Chincoteague, and the intervening farms. However, since the sound attenuates rapidly, is of low frequency, and occurs on an infrequent basis, such sound levels have not been perceived as a noise impact by the public. This is supported by the lack of noise complaints regarding rocket launches.

The noise levels generated and the frequency spectrum are primarily dependent upon the thrust level of the rocket engines. The generalized relationship

between the rocket thrust level and the OSPL at a distance of 1,000 ft (305 m) is depicted in Figure 3 (Ref. 20). The OSPL is approximately proportional to the square root of the thrust. For a particular thrust level, the OSPL represents the observed "upper bound" that could be expected. This relationship in conjunction with the "inverse square law" was used to estimate OSPLs at varying distance from the launch pad for the launch of the Conestoga (Ref. 33). This method of estimating OSPLs was developed using noise data from numerous rocket launches. It incorporates atmospheric attenuation effects, directivity of rocket noise and varying meteorological conditions.

The Conestoga vehicle will have an estimated maximum thrust of 493,212 lb_f (2.2 million newtons) on lift-off. Based on this thrust, a maximum OSPL of 130 dB could occur within 0.4 mi (0.7 km) of launch pad. This level would extend approximately 0.1 mi (0.2 km) into the salt marsh west of the launch pad. With the above maximum thrust, an OSPL of 120 dB would occur within 1.4 mi (2.2 km) of the launch pad. This level would extend approximately 5,600 ft (1,710 m) into the salt marsh west of the launch pad. The closest off site upland area west of the launch pad, approximately 1.7 mi (2.8 km), would have a maximum OSPL of 118 dB for less than 10 seconds.

The highest OSPL (>140dB) and greatest potential for structural and hearing damage is expected to occur in the near field area approximately 300 ft (90 m) surrounding the launch pad. However, no noise impacts are anticipated to occur within this region because the area does not include any buildings and will be cleared of people prior to any launches. Persons who may normally perform duties within 300 feet (90m) of the pad will be evacuated to blockhouses or positioned off Wallops Island during a launch. The estimated size of the near field region was calculated using a standard near field calculation formula where the near field is equal to 43 times the combined diameters of the rocket motors (Ref. 15).

Based on the damage criteria in Table 4.1, persons exposed to an OSPL of 120 dB for 60 seconds may be adversely affected by such noise levels. The closest off-site upland area subject to noise generated during the launch of the Conestoga vehicle will be below this threshold. Although the maximum OSPL for

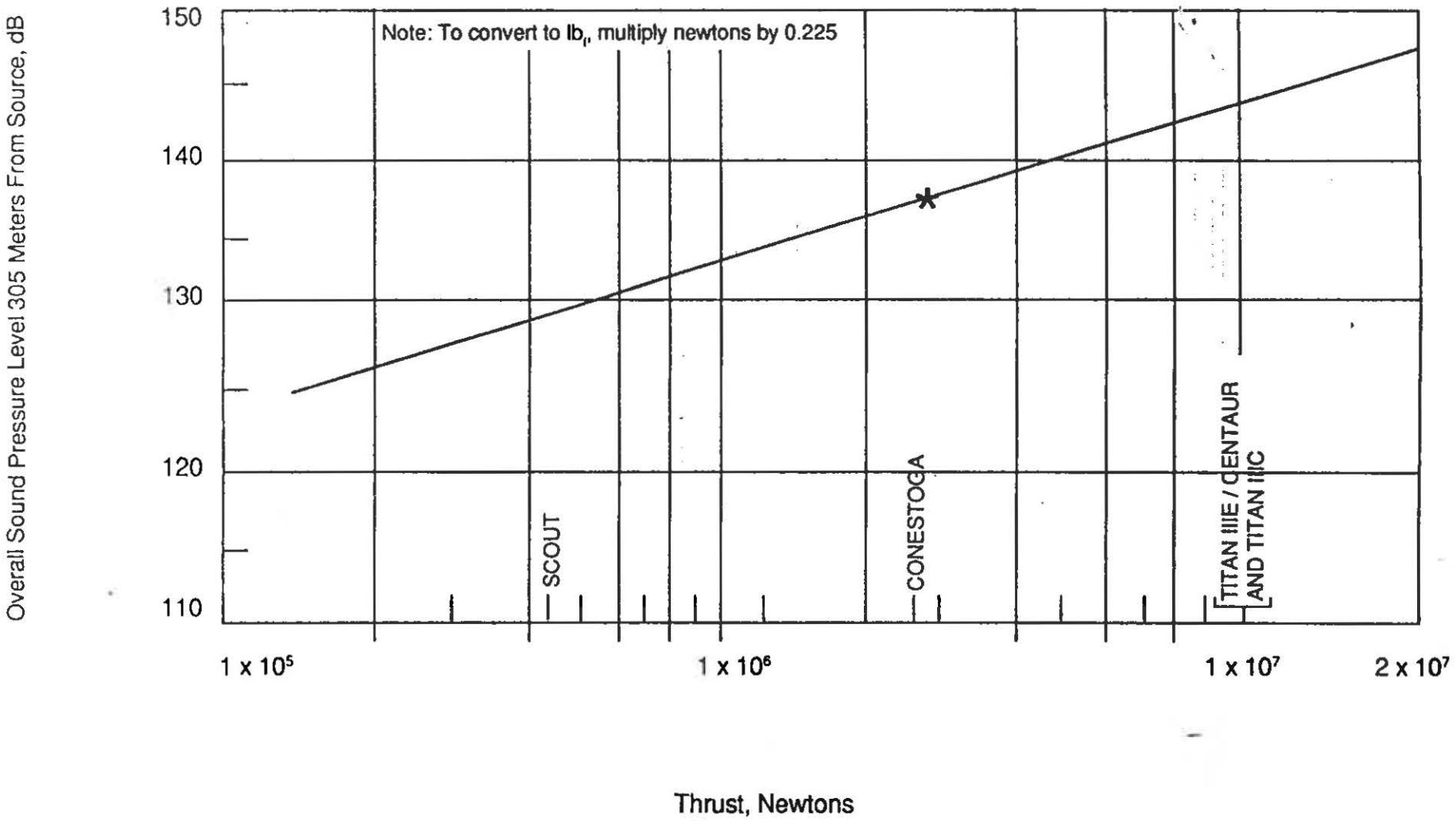

Figure 3

Approximate Relationship Between Vehicle Thrust and Overall Sound Pressure Level at 1000 Feet (305 Meters)

Source: Office of Commercial Space Transport, U.S. Department of Transportation, "Programmatic EA of Commercial Expendable Launch Vehicle Program," Washington, D.C., 1986

the closest off-site upland area is below the damage threshold both in terms of peak decibels and duration of exposure, access will be controlled within at least 1.4 mi (2.2 km) of the launch pad which includes the marsh between Wallops Island and the mainland and the area extending into the Atlantic Ocean. Since the public would not be exposed to levels greater than OSPL of 120 dB, the hearing of the public is not anticipated to be impaired by the launch of the Conestoga vehicle.

No off-site structures will be exposed to OSPL of 130 dB or greater. Therefore, no structural impacts are anticipated to result from the launch of the Conestoga vehicle. The nearest off-site structure, a single-family residence, is approximately 2.1 mi (3.3 km) from the launch pad. This structure will be exposed to OSPL levels of approximately 116 dB which is well below the level for structural damage level of 130 dB.

No direct adverse health effects or structural damage is anticipated from the launching of the Conestoga vehicle at GSFC/WFF Launch Range. However, areas up to 13.6 mi (22 km), which include portions of Chicoteague National Wildlife Refuge and Assateague Island National Seashore, will potentially be subjected to OSPL of 100 dB, predominantly composed of low frequencies. Low-frequency sounds of this intensity have been known to cause vibrations of windows, building panels, and dishes (Ref. 17). The OSPL of 100 to 110 dB in the towns of Atlantic and Chincoteague is anticipated to last less than 30 seconds. Similarly, due to the short duration of elevated noise levels resulting from the infrequent Conestoga launches, no adverse impacts to the national wildlife refuge and national seashore areas are expected. The OSPL +/- 3 dB of the peak is anticipated to last less than ten seconds (Ref. 4). The response by the public to such affects is difficult to predict.

The Scout rocket is the largest launched to date from GSFC/WFF Launch Range. The difference in overall OSPL between a Scout and a Conestoga vehicle launch is estimated to be approximately 7 dB. The increase in noise level of the

Conestoga vehicle will be noticeable but is not considered significant. A sound level change of 3 or 4 dB are barely perceptible (Ref. 19). A 10-dB change is perceived by most people as twice as loud.

In summary, it appears no significant noise impacts will occur to the public or off-site structures from the Conestoga vehicle from the proposed launch site. These findings are consistent with the Programmatic EA regarding assessments of noise impacts associated with launches of commercial expendable vehicles (Ref. 20).

4.3 WATER QUALITY

Water quality impacts from proposed vehicle launches similar to the Conestoga/COMET program at GSFC/WFF were evaluated in the 1986 DOT Programmatic EA. The general sources of environmental effects on water quality imposed by ELV operations and applicable to the Conestoga are: 1) wastewater treatment plant discharges; 2) runoff; 3) impact on spent ELV stages; and 4) accidental release potential. The actual impacts at GSFC/WFF for the above concerns are presented below.

The proposed project will not affect wastewater treatment plant operations at GSFC/WFF. It is likely that stormwater runoff will collect aluminum oxide particulates which settled following launch. Aluminum oxide is not listed by EPA as a hazardous substance which requires special treatment or disposal. Numerous NASA studies have evaluated the hydrogen chloride-aluminum oxide scavenging process (Refs. 2, 5, 8, 26). Aluminum oxide particulates are known to gather water vapor and hydrogen chloride gas to form acidic droplets in the immediate vicinity of the pad. Should a storm event occur soon after a launch event, the potential for strongly acidic stormwater runoff from the pad area exists. However, since launches under potentially adverse weather conditions will not occur, the chances of a storm event very soon after a launch are small. It is possible due to the close proximity of Hog Creek, approximately 0.1 mi (0.2 km) from the launch pad, that short-term surface water pH levels may decrease as a result of localized emission cloud formation. Monitoring of estuarine surface waters at the Kennedy Space Center following much larger SRM launches noted sharply spiked depressions of pH of several units lasting one

to two hours with rapid recovery to baseline conditions (Ref. 14). Given the relatively high salinities of estuarine and ocean waters along with predictable pH stabilities of those waters, major short-term and long-term adverse impacts to surface waters are not expected.

The potential impact of spent stages on water quality is minimal. Remaining ammonium perchlorate in spent stages which may land in the ocean should involve only small amounts of remaining propellant. Even under unexpected incomplete combustion of a given stage with SRM propellant, the ammonium perchlorate in a binder will dissolve slowly with only very localized impacts to marine life (Ref. 18).

Substantial impacts to water quality as a result of accidental release of propellants from the Conestoga are not expected. The probability of accidental release of propellant during the early stages of flight have been estimated to be one percent (Ref. 20). Once ignited, solid rocket propellants normally continue to burn until exhausted.

4.4 FLORAL AND FAUNAL COMMUNITIES

Acid cloud deposition from rocket exhaust and elevated noise levels are the primary potential impacts to floral and faunal communities from the proposed launches of the Conestoga/COMET program. The type of launch vehicle to be utilized at Wallops Island is larger than the past Scout launches. The flame impact area of the Conestoga is likely to be deflected 200 to 300 feet (60-90 m) at Wallops Island.

Launch impacts to floral and faunal communities have been discussed in several documents (Refs. 13, 20, 22, 25). The primary dune, dune meadow, and thicket vegetative communities will be the most highly impacted zones due to the close proximity to the COMET pad. Impact on the beach and tidal marsh communities should be reduced due to the greater distance from the launch area.

High humidity conditions tend to increase the acidity of the ground cloud as water vapor scavenges hydrogen chloride from the exhaust emission. Such

short-term acidic conditions have been documented to result in plant mortality or growth inhibition to sensitive species adjacent to the launch pad (Ref. 25). This study revealed that thick cuticled species and grasses which are adapted to salt spray were more tolerant of launch conditions. It was also found that the tolerant vegetation would recolonize the near field area around the pad provided successive launches were conducted months apart. Since the shrub species in general were less tolerant of the near-field effects, the vegetative community has a tendency to evolve to a less sensitive grass or herb community. If sufficient time is not allowed between successive launch events, the area ultimately becomes barren and consequently more susceptible to erosion. Wax myrtle, a shrub common to the thicket area in the vicinity of the proposed COMET pad, is fairly resistant to near-field effects. This tolerance, coupled with the few launches proposed per year, should preclude a shift to any herbaceous community structure.

No loss of wetlands is expected to occur from the proposed project. The closest wetland is an estuarine marsh west of the proposed site which is approximately 0.2 mi (0.3 km) from the proposed launch site. Ground cloud formation which may result in short-term impacts to proximal vegetative species and soils has been well documented (Refs. 10, 22, 25, 26). Salt-tolerant species such as those in the estuarine marsh are relatively resistant and should maintain their overall frequency and cover. Launches on a monthly basis could possibly eliminate ground cover surrounding the pad area with subsequent erosion and leaching of soil nutrients with eventual discharge into the wetland system. Increased nutrient loading could adversely impact the water quality and benthic population in the wetland system. The maximum estimated three launches per year (1994-1996) is unlikely to permanently eliminate adjoining groundcover so that the potential nutrient loading described above is not expected. If additional launches of similar, or larger, vehicle size are scheduled for the same pad proposed for the Conestoga, future EAs should address the potential for cumulative impacts of multiple launches.

Without confirmed evidence of such, it is assumed that vibrational and noise disturbances affect the flight of the mobile faunal species. The avian

population will more than likely be the largest segment of fauna impacted. Temporary interruption of foraging activity of shore birds, wading birds, and song birds utilizing the immediate area of the proposed launch site is anticipated. Additionally, short-term launch disruption of nesting activity of song birds, small mammals, or herpetofauna of the dune meadow/thicket mosaic near the pad is expected. Temporary interruption of foraging activity of the latter two species will also occur. Due to the short duration of launch (less than 30 seconds) and infrequency of launches, the impact to these species is considered minimal.

In summary, based on experience over many years around government launch sites, there are no known significant long-term or cumulative impacts to faunal species due to ELV launches (Ref. 20). There is evidence that thin cuticled floral species in the immediate vicinity of the launching pad are susceptible to damage from the exhaust cloud. Thick cuticled species such as wax myrtles, cordgrass, sedges, and graminoid species are tolerant of these conditions (Ref. 25).

4.5 THREATENED AND ENDANGERED SPECIES

Minimal impact to threatened or endangered species is anticipated to result from the launch of the Conestoga vehicles from the COMET pad. A Biological Information Report was recently prepared addressing 13 listed species (Ref. 24). In addition to five marine turtles and five whale species, impacts to the peregrine falcon, bald eagle, and piping plover were assessed. No critical habitat for any of the federally listed species has been designated at Wallops Island. However, the USFWS is considering undeveloped areas south of the existing facilities on the southern end of the island as well as areas at the north end of the island for possible critical habitat designation for the piping plover. Similar to other avian species, vibrational and noise disturbances during launch could temporarily disrupt the activities of the species. Since the documented plover nesting site on the south end of Wallops Island is a minimum of 0.9 mi (1.4 km) from the pad, minimal impact to the nesting activity of the species is anticipated. Due to the infrequent launch schedule and the short duration of vibrational and noise disruption to the

area (less than thirty seconds), nesting and foraging impacts to these species are expected to be minimal. In addition to the aforementioned species, the Wilson's plover, listed as endangered by the VDGIF, has been documented nesting with the piping plovers on the south end of Wallops Island. The concerns enumerated for the piping plover should suffice for the Wilson's plover since nesting requirements and seasons are similar. The gull-billed tern is presently listed as threatened by the VDGIF. The only documented nesting of this species is on an island off the northern part of Wallops Island, well outside of the impact area adjacent to the proposed COMET pad. Temporary disruption of feeding activity near the COMET pad complex during launches is the only impact anticipated to this species. The northern harrier (Circus cyaneus), a species recommended for an endangered status by the VDGIF, nests on Wallops Island (Ref. 21). Nesting of the harrier is confined to open fields and marshes. The nearest suitable nesting habitat to the COMET pad of this species is the tidal marsh approximately 0.2 mi (0.3 km) to the northwest; however, no nests have been documented in this area. Temporary disruption of nesting and foraging activity of this species is anticipated during launches. Due to the number and duration of launches, minimal impact to the species is anticipated. The northern diamondback terrapin (Malaclemys terrapin), a species which is a candidate for federal protection, inhabits the tidal marsh around Wallops Island (Refs. 3, 21). Temporary disruption of foraging activity of the species is anticipated during launch events. Both short-term and long-term impacts to the species are expected to be minimal. Documented concurrence by the USFWS and National Marine Fisheries Service (NMFS) with the determination of no effect on endangered species is provided in Appendix 1.0.

4.6 HEALTH AND SAFETY

Launch Vehicle Assembly

No adverse environmental impacts as related to health and safety are expected to occur as a result of the proposed Conestoga/COMET program at GSFC/WFF from vehicle assembly. Vehicle assembly protocols will follow the engineering/manufacturers specifications which meet or exceed NASA safety requirements. GSFC/WFF will enforce NASA and OSHA safety requirements during

all staging operations of the Conestoga. Past measures have been taken to protect the existing facilities from potential flooding such as raising floor elevations, installing flood-control devices in buildings, and providing elevated storage and work space. In the event of potentially severe flooding, the island would be evacuated. Conestoga/COMET operations will follow the GSFC evacuation plan including protection of personnel and transfer/securing of equipment in the event of potential flood conditions.

Facilities which house the SRMs and ordnance material are stored in facilities which meet NASA QD requirements. The QD requirements are established to isolate buildings which involve hazardous operations or store hazardous substances to minimize the impact or energy that the release or explosion of these hazardous materials may have on adjoining buildings and personnel. The SRMs are relatively stable with a well-established history of use and behavioral characteristics (Ref. 28). Accidental ignition of a motor will cause a rapid burn of the propellant. Injury to personnel from the flash ignition is possible. It is also possible that an accidentally ignited motor could result in forward propulsion of that motor. GSFC/WFF Range Safety will be responsible for ensuring that all ground safety criteria has been met prior to launch. There are on-site emergency response personnel supported by additional emergency support as described in Section 3.6.

Payloads

The COMET payloads are not expected to pose substantial environmental risk. As noted in Section 2.1.3, Payload Description, the proposed payloads do not involve exotic species, infectious agents, or radiological materials. Minimal processing of the payload experiments will be necessary at GSFC/WFF. The use of hazardous materials will be limited. Experimenters will provide chemical species and quantities of hazardous materials to EER with sufficient lead time to ensure that proper health, safety, and environmental precautions are established. EER will provide this information to GSFC/WFF personnel. Provisions for personal protective equipment will be the joint responsibility of the experimenters and EER, with approval by GSFC. Additionally, EER will ensure that experimenters have reviewed NASA rules, regulations, and policies to ensure that planned payload processing can be accomplished in accordance

with standard operating procedures, as well as, all applicable federal, state, and local regulations. Deficiencies will be identified and the provision of experiment specific equipment will be negotiated between EER and the experimenter on a case-by-case basis. These provisions shall be subject to approval by GSFC. In addition, each experimenter will be responsible for the removal and disposal of any experiment specific processing materials brought to the GSFC/WFF. Any hazardous waste generated from the payload processing will be incorporated into the GSFC hazardous waste disposal process. Laboratory spills of regulated substances will be cleaned up following the approved GSFC spill contingency plan. The unlikely release of the noninfectious, nonexotic biological species will be cleaned following NIH protocols.

The only potential for significant release of payloads materials into the environment would be from possible catastrophic failure of the launch vehicle at the launch facility or during launch prior to reaching orbital velocities. The launch azimuth limits are shown in Figure 4.

The COMET payloads are designed to withstand the predicted Conestoga launch accelerations. However, in catastrophic failures of the launch vehicle, dispersion of experiment contents can be expected. The total weight of all COMET payloads will be limited to 450-500 pounds (205-230 kg). The majority of this weight is comprised of structural (metal) components. Although the COMET program payloads satisfies the needs of multiple research concerns, each experiment represents only a fraction of this total weight estimate. Since increased payload weights directly increase launch costs, experiments are designed to minimize sample sizes. The net result is that both experiment and support systems are designed to process and use a variety of compounds in small individual amounts. Consequently, the risk of significant contamination of the launch pad area or ocean by the experiments is so relatively small as to be considered insignificant. Therefore, based on the types of experiments, the minimal quantities of materials involved, and the low probability of an accident releasing payload materials, potential payload impacts to the environment are considered minimal.

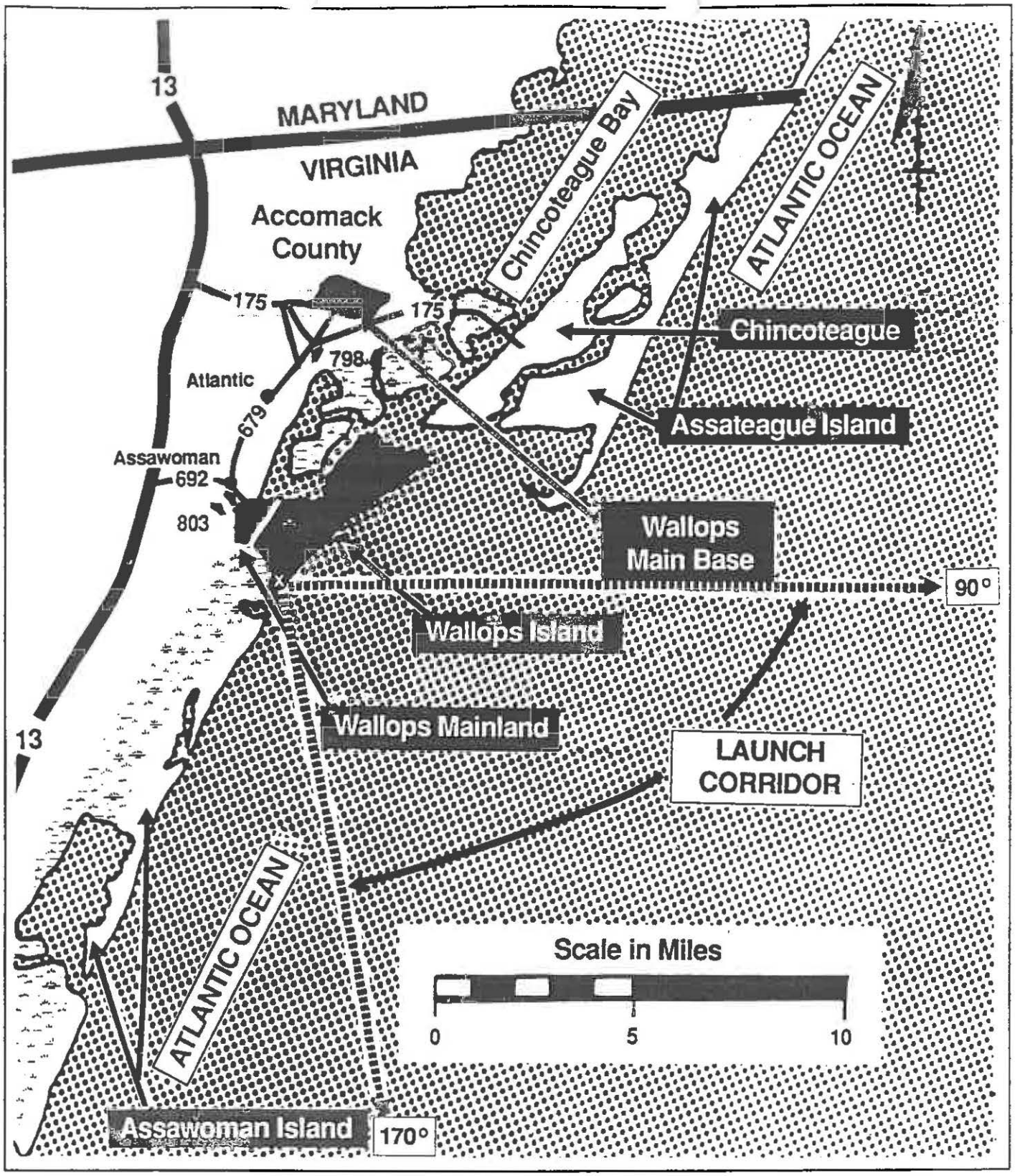

Figure 4
Launch Corridor from GSFC/WFF of Conestoga Over the Atlantic Ocean

Source: Reynolds, Smith and Hills, Inc., 1992

Legend
x - Launch Pad
(approximate location)

Launch Operations

The DOT Programmatic EA assessed the impacts of vehicles similar to the Conestoga with regard to launch mishaps and unplanned events. Evaluation of a launch pad catastrophe involving similar ELVs indicated that no significant hazard was apparent from the likely concentrations of potentially toxic materials that would be released (Ref. 20). GSFC will be responsible for clearing Wallops Island of non-essential personnel prior to lift-off. Tables of existing radar equipment and RF protection guide information is provided in the ERD (Ref. 21). All operations at GSFC are regulated by the American National Standards Institute which establishes safe exposure levels to persons exposed to RF fields. Other security measures will be taken to prevent unexpected access to the island from the west and down-range areas in the immediate vicinity of Wallops Island will also be cleared. Notifications of the time of launch and restricted areas will be provided to the public through media channels.

The probability of an in-flight abort in the early stages following launch is estimated to be approximately one percent (Ref. 20). Since the launch corridor is over the Atlantic Ocean and the failure probability is small, the expected impacts to health and safety from launch failure is minimal. GSFC/WFF has developed the launch azimuth limits which the Conestoga will follow. Stage separations will occur down range within this flight path corridor. Similar to existing procedures at GSFC/WFF and other launch facilities, notification of the launch and controlled down-range area will be provided to maritime interests.

4.7 TOXIC SUBSTANCES

There will be no impacts involving TSCA-related compounds by the proposed project. In processing the payload experiments and vehicle components at Wallops Island, it is possible that substances considered toxic pursuant to CERCLA may be used. All chemical species and amounts of these chemicals will be provided in advance by the payload experimenters and EER Systems Corporation to GSFC. As discussed previously, only small amounts of any given chemical will be necessary to complete the payload processing and vehicle assembly. Due to the limited number of anticipated annual launches

(approximately two launches per year), addition of significant chemical inventories will not be necessary at GSFC/WFF for the Conestoga/COMET program. Those chemicals which are brought to GSFC/WFF and are considered toxic will be properly handled and stored in accordance with GSFC safety requirements. Substantial impacts to the environment from toxic substances associated with the proposed project are not expected.

Permits from DOT for transfer of the SRMs onto GSFC property will be the responsibility of EER Systems Corporation. GSFC will be provided copies of all required documentation in advance of shipment of any hazardous materials including Material Safety Data Sheets (MSDS). EER Systems Corporation will ensure that applicable sections of the Superfund and Reauthorization Act (SARA) and Community Right to Know Act (referred to as SARA Title III) will be complied with for Conestoga/COMET operations.

4.8 SOLID AND HAZARDOUS WASTE

Minimal impacts from solid and hazardous wastes are expected to result from implementation of the Conestoga/COMET program at GSFC. The limited processing of the payloads which is expected to occur at the Wallops Island facility will generate solid waste which will be handled by GSFC solid waste contractors and disposed in the local landfill near Atlantic, Va. The limited number of launches per year and estimated time of additional experimenter personnel on site necessary to implement each payload processing and launch (approximately two to three months) should not overburden the existing solid waste management program.

Hazardous materials and hazardous waste are unavoidable aspects of the proposed Conestoga/COMET program. Hazardous wastes are regulated by the Resource Conservation and Recovery Act (RCRA) at the federal level. Amendments to RCRA are included in the Hazardous and Solid Waste Amendments (HSWA) of 1984. The State of Virginia regulates hazardous waste and hazardous materials through several state regulations including the Virginia Hazardous Waste Management Act and Hazardous Materials Emergency Response Act.

GSFC is registered as a large quantity generator of hazardous waste. The small amounts of hazardous waste generated during any Conestoga/COMET operation at GSFC/WFF will be labeled hazardous waste and incorporated into the GSFC hazardous waste stream for proper manifesting and disposal. Due to the small size of the individual experiments and limited processing required at GSFC/WFF, any waste which can be classified "hazardous" will be in small amounts and predominated by spent containers of those materials. The limited amounts of hazardous waste expected to be generated will not significantly increase existing hazardous waste volumes at GSFC/WFF, will not affect the facility's generator status, and should be considered a minimal impact.

4.9 ECONOMIC IMPACTS

Economic impacts associated with the Conestoga/COMET program will be twofold. The majority of impacts will be realized through the purchases that employees make during their stay in Accomack County, Virginia. Employee purchases of goods and services will primarily include lodging, food, entertainment, transportation, and retail needs. These purchases generate the next level of impacts, which are tax impacts. The purchase of goods and services will generate several taxes which are collected by the state and local governments. Primary tax impacts include sales taxes on goods (e.g., food, retail shopping, entertainment) and transient occupancy taxes which are levied on the local lodging establishments.

Since no new permanent jobs will be created at GSFC/WFF by the Conestoga/COMET program, no new employment impacts at the local level have been assumed. The project's employment will primarily consist of nonlocal technical persons sent to the facility for three- to four-month periods of time. This is the estimated preparation time for nonlocal persons arriving in the GSFC/WFF for vehicle assembly, experiment processing and the actual Conestoga launches. For the purposes of this analysis, no construction-related economic impacts have been examined or estimated.

Between 1993 and 1996, it is proposed that approximately two launches will occur in 1993 and three launches per year in 1994 to 1996. A summary of the employment levels, lengths of employment and salary levels associated with

these proposed launches is provided in Appendix 2.0. Estimates of low and high ranges of economic impacts are presented below.

The impacts to purchasing and taxes are described as follows:

Purchasing Impacts

Since technical staff for the Conestoga/COMET program will be brought in from out of the local area, there will be a notable impact on local businesses. Periodic stays in the preparation for launches will average four months and as such will require that these non-local employees find suitable accommodations. Purchases of retail goods and other services will also be necessary to maintain an adequate lifestyle. Businesses that normally record slowdowns during the off season may realize increased activity levels due to the presence of project-related employees.

Tax Impacts

The purchase of goods and services by non-local employees with the Conestoga/COMET project will benefit the state and local government tax coffers. The majority of tax benefits will result from a sales tax that is applied to goods purchased, a meals tax that is levied against prepared foods, and by a transient occupancy tax which is applied to the lodging units in the region. It is assumed that the basic goods and services purchased by the Conestoga-related employees will primarily be captured within Accomack County in Virginia. Sales tax rates were provided by the Virginia Department of Taxation. A sales tax rate of 4.5 percent is applied to purchases in Accomack County. Of this total, 3.5 percent goes to the state and one percent is kept locally. The meals tax of four percent is retained locally. Therefore, tax impacts related to this levy are retained locally, primarily within Chincoteague.

As a part of this analysis, only the impacts generated by nonlocal employment of the Conestoga/COMET project have been estimated. Several types of additional impacts could conceivably be accounted for by the operations. Expenses and output costs will be incurred in the day-to-day operations; other operating expenses including materials, business supplies, and utilities will

also result. Furthermore, day-to-day maintenance of the facility, when not being utilized, will require additional resources. As a result, the impacts summarized in this report are conservative since several categories that are difficult to estimate have been omitted from the analysis. Still, the impacts generated by the proposed project will substantially contribute to the economy of the local community. Between 1993 and 1996, combined purchase and tax impacts will very conservatively approach $2.3 million and could conceivably reach $4.3 million. The range of impacts represented by these operations will primarily benefit those businesses in Accomack County but will not prevent additional expenditures and impacts from occurring in surrounding counties and lower Maryland. A summary of the estimated annual impacts for Accomack County is contained below:

Table 4-4. Summary of Annual Economic Impacts (1993-1996)

Year	Purchase Impacts	Tax Impacts
1993	789,100-1,183,700	23,000-34,600
1994	493,200-986,400	14,400-28,800
1995	493,200-986,400	14,400-28,800
1996	493,200-986,400	14,400-28,800
Cumulative Total Impacts Range	$2,268,700-$4,142,900	$66,200-$121,000

Implementation of the Conestoga/COMET program will be a positive impact to the county and surrounding areas.

4.10 LAND USE AND INFRASTRUCTURE IMPACTS

The GSFC/WFF is an existing launch facility with a 46-year history of launch vehicle operations. Increase in noise levels with the Conestoga will occur but the short duration and estimated occurrence (two launches per year) is not likely to impact land use. All land use within approximately two miles of the launch facility are open water and coastal marsh or lands owned and occupied by the GSFC.

As a relatively remote island facility surrounded by primarily agricultural lands, the effect of the proposed Conestoga launch vehicles will be minor as related to land use.

Analysis of payloads to be launched with the Conestoga launch vehicle indicates no substantial land use impact from either payloads in normal launches or catastrophic launch failures.

The continued use of GSFC/WFF for rocket launches including the Conestoga is consistent with the Accomack County Future Land Use Map.

APPENDIX 1.0

CLINTON V. TURNER
COMMISSIONER

COMMONWEALTH of VIRGINIA

C. KERMIT SPRUILL, JR.
DIRECTOR

DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
Division of Product and Industry Regulation
P. O. Box 1163, Richmond, Virginia 23209

March 11, 1992

Terry M. Potterton
Associate Chief, Health, Safety,
and Security Office
NASA
Goddard Space Flight Center
Wallops Island, Virginia 23337

Dear Mr. Potterton:

This letter is in response to your request for information on state listed threatened or endangered plant or insect species in the vicinity of Wallops Island, Virginia. To date, there are no known state listed endangered or threatened plant or insect species in the immediate vicinity of Wallops Island.

The Virginia Department of Agriculture and Consumer Services has jurisdiction over state listed plant and insect species only. Additional information on unique geologic formations, rare habitat and species, and candidates proposed for listing can be obtained from Mr. Thomas L. Smith at the Division of Natural Heritage (804-786-7951). This information should be readily available from their database.

Thank you for your interest in the endangered or threatened plant or insect species in Virginia. If you have any questions or need any additional information, please contact me.

Sincerely,

John R. Tate
Endangered Species Coordinator
(804) 786-3515

cc: Thomas L. Smith

ADMINISTRATION
NATURAL HERITAGE
PLANNING AND RECREATION RESOURCES
SOIL AND WATER CONSERVATION
STATE PARKS

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

DIVISION OF NATURAL HERITAGE

Main Street Station, 1500 East Main Street – Suite 312

TDD (804) 786-2121 Richmond, Virginia 23219 (804) 786-7951 FAX: (804) 371-2674

March 19, 1992

Terry M. Potterton
Associate Chief, Health, Safety and Security Office
National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

Re: COMET Launches, Wallops Flight Facility, Wallops Island, VA

Dear Mr. Potterton:

In response to your recent request for information, the Department of Conservation and Recreation's Division of Natural Heritage (DNH) has searched its Biological and Conservation Datasystem (BCD) for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources (NHR's) are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, there are no natural heritage resources documented in the project area. The absence of data does not necessarily mean that natural heritage resources do not exist on or adjacent to the project site, but rather that our files do not currently contain information to document their presence.

DNH's Biological and Conservation Datasystem is constantly growing and revised. Please contact DNH for an update on this natural heritage information if a significant amount of time passes before it is utilized.

Thank you for the opportunity to comment on this.

Sincerely,

Laurel E. Bateman

Timothy J. O'Connell
Environmental Review Coordinator project.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
One Blackburn Drive
Gloucester, MA 01930

MAR 27 1992

Terry M. Potterton
National Aeronautics and
Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

Dear Mr. Potterton:

This is in response to your letter requesting concurrence with your determination that activities involved in the launching of Commercial Experiment Transporter (COMET) missions using a Conestoga class launch vehicle will not affect endangered or threatened species under the jurisdiction of the National Marine Fisheries Service. There are several endangered whale and sea turtle species that inhabit the nearshore waters off Wallops Island. However, we do understand that the proposed launch activities do not represent a significant increase in down-range noise level. Therefore, we can concur that the launch activities are not likely to adversely affect endangered species under our jurisdiction, and that there is no need for further consultation pursuant to Section 7 of the Endangered Act of 1973, as amended. Should project plans change or new information become available that changes the basis for this determination, then consultation should be reinitiated.

Sincerely,

Richard B. Roe
Regional Director

COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries
May 7, 1992

Mr. Terry M. Potterton
Associate Chief, Health, Safety,
and Security
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

Re: Commercial Experiment Transporter (COMET) Launches -
Wallops Island Facility
Accomack County

Dear Mr. Potterton:

We have reviewed your recent inquiry regarding proposed commercial launch activity at the Goddard Space Flight Center's Wallops Flight Facility. Based upon our review of the documents you submitted, and upon FWIS database review regarding presence of endangered or threatened species, or other sensitive wildlife resources, we do not anticipate significant adverse impacts upon fish and wildlife resources under our jurisdiction to result from your proposed project. If we receive information which would affect this determination, we will provide additional comments to you as appropriate. Thank you for consulting with us on this issue. Please call me at (804) 367-8999 if we may be of further assistance.

Sincerely,

Raymond T. Fernald, Manager
Environmental Services Section

RTF/mbm

4010 WEST BROAD STREET, P.O. BOX 11104, RICHMOND, VA 23230-1104
(804) 367-1000 (V/TDD) *Equal Opportunity Employment Programs & Facilities* FAX (804) 367-9147

United States Department of the Interior

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
MID-COUNTY CENTER, U.S. ROUTE 17
P.O. BOX 480
WHITE MARSH, VIRGINIA 23183

MAY 21 1992

Mr. Terry M. Potterton
National Aeronautics and
Space Administration
Wallops Island Flight Facility
Wallops Island, Virginia 23337

Re: Commercial Experiment Transporter
Launches at Wallops Island, Virginia

Dear Mr. Potterton:

This responds to a telephone call from Ms. Pam Whitman on April 29, 1992 requesting a meeting to discuss the impacts of the three commercial experiment transporter launches to be conducted at Wallops Island, Accomack County, Virginia on the piping plover (Charadrius melodus), a Federally listed threatened species. As we stated in our April 2, 1992 letter, piping plovers have been found at both ends of the island and are known to nest on the southern end where the launches will take place. During the telephone conversation, Ms. Whitman indicated that the first launch would not occur until January, 1993 and that the additional launches would occur every four months.

Since that time, we have discussed this project with Ms. Karen Terwilliger and Mr. Robert Cross of the Virginia Department of Game and Inland Fisheries. Ms. Terwilliger and Mr. Cross are familiar with piping plovers and their use of Wallops Island. Based on these discussions, we have determined that because the launches are few in number and will not occur on a regular basis, impacts to plovers are not likely.

This concludes informal consultation on this project. If you have any questions or need further assistance, please contact Cindy Schulz of this office at (804) 693-6694.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

COMMONWEALTH of VIRGINIA

Hugh C. Miller, Director

Department of Historic Resources
221 Governor Street
Richmond, Virginia 23219

TDD: (804) 786-1934
Telephone (804) 786-3143
FAX: (804) 225-4261

June 9, 1992

Terry M. Petterton, Associate Chief
Health, Safety, and Security Office
NASA
Goddard Space Flight Center
Wallops Flight Facility
Wallops island, Virginia 23337

RE: COMET Launches, Wallops Island Flight Facility, Accomack County
(DHR Project File #92-0458-F)

Dear Mr. Petterton:

Thank you for your letter of May 22 which responded to the concerns we had regarding the proposed COMET launches at the Wallops Flight Facility. I understand from your letter and from conversations my staff has had with Pam Whitman of your office that the COMET launches are not substantially different from other launches which take place as a matter of normal operations at the flight facility. Based on that and on your statement that noise modeling has shown that the launches will not result in structural damage to nearby architectural resources, we concur with your finding that the launches will have no effect on cultural resources in the area.

Thank you for the opportunity to comment on this undertaking. Please contact Mary Harding Sadler of our office if you have any questions concerning our review of the COMET launches.

Sincerely,

Bruce J. Larson
Head, Project Review Section

APPENDIX 2.0

CONESTOGA/COMET PROGRAM
PROPOSED FOR GSFC/WFF
SUPPLEMENTARY ECONOMIC INFORMATION

The information in Appendix Tables 2-1 and 2-2 was provided by EER Systems Corp., Inc.

Table Appendix 2-1. Employment Levels Representing the Low Range of Impacts for Conestoga/COMET Project

Category	1993	1994	1995	1996	Annual Average
Estimated Employment (#persons)	80	50	50	50	58
Length of Stay	4 months	4 months	4 months	4 months	4 months
Average Annual Salary	$50,000	$50,000	$50,000	$50,000	$50,000

Table Appendix 2-2. Employment Levels Representing the High Range Impacts for the Conestoga/COMET Project

Category	1993	1994	1995	1996	Annual Average
Estimated Employment (# persons)	120	100	100	100	105
Length of Stay	4 months	4 months	4 months	4 months	4 months
Average Annual Salary	$50,000	$50,000	$50,000	$50,000	$50,000

The levels of employment utilized in the estimation of economic impacts are summarized for purchases and tax collections in the following sections:

Purchasing Impacts

The purchase of goods and services by each employee has been estimated on a daily basis. Information on nonlocal visitor expenditures (including seasonal

stays) was provided by the Virginia Department of Commerce, Division of Tourism. According to the department, seasonal visitors spend an average of $70 per day. Approximately 35 percent of this amount or $24.50 is accounted for by traveling costs (air, auto, etc.) and was not included as an impact in this analysis. It was assumed that the majority of employees travelling to the region would be driving their own vehicles. The remaining 65 percent of the $70-per-day expenditure was used to estimate employee purchase impacts. Adjustments were made to the lodging expenditures and were based upon local lodging costs and conditions observed during previous operation. All other figures were supplied by the Division of Tourism.

It is estimated that the additional employees involved with the Conestoga/COMET project will spend an average of $82.80 per day on required goods and services. As stated previously, the figures in Table Appendix 2-3 represent a per-person average for each visitor to Virginia and are somewhat conservative since the annual income represented by Conestoga-related employees is higher than that of the average Virginia visitor.

Table Appendix 2-3. Daily Expenditure Estimates for Conestoga/COMET Project Employment in the GSFC/WFF Area

Category	Per Diem Amount	Percent of Total Expenditure
Food	$19.60	18%
Lodging	50.00[1]	47%
Retail Goods	7.00	7%
Recreation/Entertainment	5.60	5%
Total[2]	$82.80	77%

[1]This figure is higher than the figure supplied by the Virginia Division of Tourism. This is primarily based upon local lodging costs and conditions.
[2]Excludes transportation costs of $24.50 or 23 percent of the revised total.

Purchase impacts (both high and low) indicate the following estimated annual impacts.

Table Appendix 2-4. Purchase Impacts for the Conestoga/COMET Project in the GSFC/WFF Area

Year	Low	Median	High
1993	$789,100	$986,400	$1,183,700
1994	493,200	739,800	986,400
1995	493,200	739,800	986,400
1996	493,200	739,800	986,400
Cumulative Range	$2,268,700	$3,205,800	$4,142,900

As seen above, cumulative purchasing impacts could realistically approach $4.1 million between 1993 and 1996. On an annual basis, these impacts should range from $500,000 to nearly $1.2 million. No adjustment for inflation or cost of living has been included in this estimate.

Tax Impacts

Information on the meals tax in Chincoteague was supplied by the Chincoteague Town Council. The transient occupancy tax rate was obtained from the Accomack Commissioner of Revenue. This tax on lodging is currently two percent in Accomack County. Impacts for each of the taxes collected are shown in Tables Appendix 2-5 and Appendix 2-6.

Table Appendix 2-5. Low-Range Tax Impacts Resulting from Conestoga/COMET Project Employment

Year	Purchases	Lodging Expenses	Tax Impacts		
			State	Local	Total
1993	$309,100	$480,000	$7,500	$15,500	$23,000
1994	193,200	300,000	4,700	9,700	14,400
1995	193,200	300,000	4,700	9,700	14,400
1996	193,200	300,000	4,700	9,700	14,400
Cumulative Totals (1993-1996)	$888,700	$1,380,000	$21,600	$44,600	$62,200

Similar impacts based upon a higher range of employment may be realized. Estimates of these impacts are shown below:

Table Appendix 2-6. High-Range Tax Impacts Resulting from Conestoga/COMET Project Employment

Year	Purchases	Lodging Expenses	Tax Impacts		
			State	Local	Total
1993	$463,700	$720,000	$11,300	$23,300	$34,610
1994	386,400	600,000	9,400	19,400	28,800
1995	386,400	600,000	9,400	19,400	28,800
1996	386,400	600,000	9,400	19,400	28,800
Cumulative Totals (1993-1996)	$1,622,900	$2,520,000	$39,500	$81,500	$121,000

As shown, cumulative tax impacts (both state and local) should range from $66,000 to a high of $121,000 for the five-year period.

APPENDIX 3.0

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