NASA CONTRACT NO. NASW-4598
NASA TASK ASSIGNMENT NO. 27

MODIFICATIONS TO LANGLEY 14-BY 22-FOOT SUBSONIC TUNNEL, BUILDING 1212C LANGLEY RESEARCH CENTER HAMPTON, VIRGINIA

APRIL 1993

Prepared By:

Ebasco Services Incorporated

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA CONTRACT NO. NASW-4598
TASK ORDER NO. 27

ENVIRONMENTAL ASSESSMENT FOR MODIFICATIONS TO LANGLEY 14- BY 22-FOOT SUBSONIC TUNNEL, BUILDING 1212C

LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
EA	Environmental Assessment
FONSI	Finding of No Significant Impact
km	Kilometers
LaRC	Langley Research Center
LHB	Langley Handbook
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHB	NASA Handbook
SHPO	State Historic Preservation Officer
VRF	Vortex Research Facility
V/STOL	Vertical/Short Takeoff and Landing

1.0 SUMMARY AND CONCLUSIONS

The proposed action is designed to support the National Aeronautics and Space Administration's (NASA) continuing studies of the aerodynamics of vertical/short takeoffs (V/STOL) and landing aircraft configurations. Recent experimental results have shown that rate-of-descent is a very important parameter in analyzing ground effects. Also, flight data have shown that aircraft undergoing high-rate maneuvers can experience engine compression stalls due to flow problems associated with the high incidence flow entering the engine inlets. The need has been identified for wind-tunnel investigation of rate-of-descent effects and large-amplitude, high-rate angular motion. Modifications to the existing Langley 14- by 22-Foot Subsonic Tunnel are proposed to enable these types of investigations to be performed. The proposed modifications consist of development and installation of a new model support system in addition to the model support systems presently in use at the tunnel facility.

The proposed action, the No-Action alternative, and the New-Construction alternative were considered in this Environmental Assessment (EA). The No-Action alternative will not fulfill NASA's objective to perform wind-tunnel investigation of rate-of-descent and large-amplitude, high-rate, angular motion. The New-Construction alternative will be time- and cost-prohibitive.

Based on the evaluations presented in this EA, the environmental impacts associated with the proposed modifications to the Langley 14- by 22-Foot Subsonic Tunnel will not individually or cumulatively have a significant effect on the quality of the environment. A Finding of No Significant Impact (FONSI) is recommended.

2.0 PURPOSE AND NEED

2.1 FACILITY BACKGROUND

The Langley 14- by 22-Foot Subsonic Tunnel (Building 1212C) at the National Aeronautics and Space Administration (NASA)/Langley Research Center (LaRC) came on-line in 1970. This facility is used for low-speed testing, specializing in take-off and landing of fixed-wing and rotor-wing aircraft.

2.2 PROJECT OBJECTIVE

The primary objective of the proposed action is to provide ground-based wind-tunnel data of actual flight conditions during landing and high-rate angular motion in maneuvering. Recent experimental results obtained in the Langley Vortex Research Facility (VRF) have shown that rate-of-descent is a very important parameter in analyzing ground effects. Flight data have shown that aircraft undergoing high-rate maneuvers can experience engine compressor stalls due to flow problems associated with the high-incidence flow entering the engine inlets. The next generation of fighter aircraft will be required to perform short take-offs and landings, and will need to possess extreme maneuver capability. Both parameters are critically important to the development of these future aircraft. Currently, no capability exists for wind-tunnel investigation of rate-of-descent effects and large-amplitude, high-rate angular motion.

Rate-of-descent, large-amplitude and high-rate angular motion studies in wind tunnels require a specific type of model support system. The proposed action will provide a model support system for the Langley 14- by 22-Foot Subsonic Tunnel which will allow the vertical motion speeds and angular pitch rates needed to simulate the desired test parameters. The model support systems presently in use at the tunnel facility do not support these types of investigations.

2.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) addresses environmental issues related to the proposed modifications to the Langley 14- by 22-Foot Subsonic Tunnel. This EA was prepared in accordance with the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA) (40 CFR Parts 1500 - 1508) and NASA's regulations implementing the provisions of NEPA (14 CFR Part 1216.3, as addressed in NHB 8800.11 and LHB 8800.1).

3.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

3.1 FACILITY DESCRIPTION

The existing Langley 14- by 22-Foot Subsonic Tunnel (Building 1212C) is located along the western perimeter of the NASA LaRC West Area, along Virginia State Route 172, in the Hampton Roads area of southeastern Virginia (Figure 1). This facility is located in a densely developed area of LaRC. The Langley 14- by 22-Foot Subsonic Tunnel is a closed-circuit, single-return, atmospheric wind tunnel with a test section which can be operated in a variety of configurations - closed, slotted, partially open, and open. The closed test-section configuration is 14.5 feet (4.42 meters) high by 21.75 feet (6.63 meters) wide by 50 feet (15.24 meters) long with a maximum speed of about 338 feet/sec (103 meters/sec). The open test-section configuration, which has a maximum speed of about 270 feet/sec (82 meters/sec), is formed by raising the ceiling and walls to form a floor-only configuration. The tunnel may be configured with a moving-belt ground plane and a floor boundary-layer removal system at the entrance to the test section for ground-effect testing. In addition, the tunnel has a two-component laser velocimeter, a frequency-modulated tape system for dynamic data acquisition, flow-visualization equipment, and acoustic testing capabilities. The test medium is outdoor air at atmospheric conditions (Gentry et al., 1990).

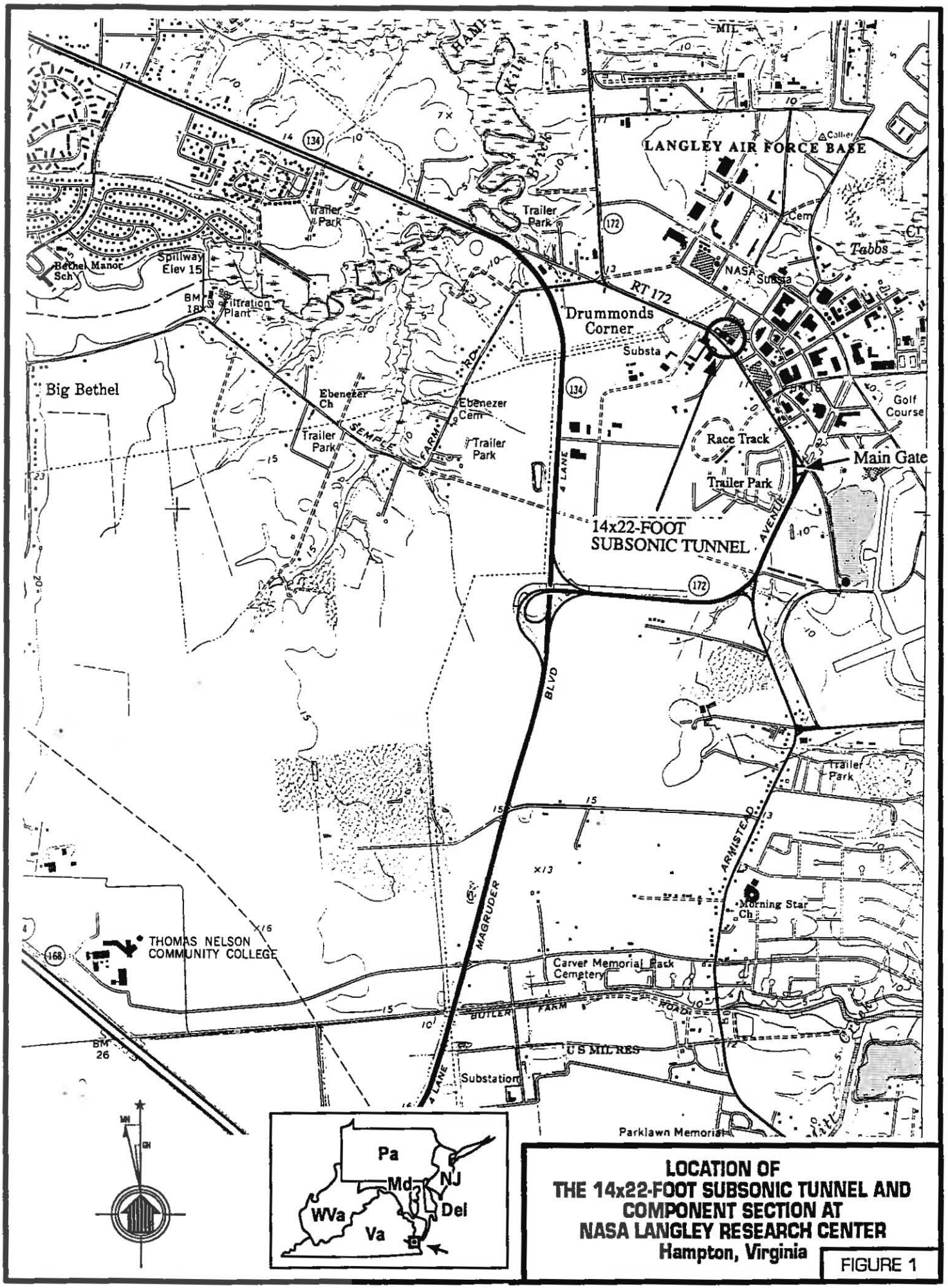
The model support systems at the Langley 14- by 22-Foot Subsonic Tunnel consist of a number of carts (some of which have a moving belt ground plane to simulate landing) which are emplaced for testing from underneath the test section (i.e., the top of the model cart is the floor of the test section). The carts can be inserted into the front or back bay of the test section.

The Langley 14- by 22-Foot Subsonic Tunnel is used for low-speed (<230 miles/hour (<370 km/hour)) performance testing of aircraft models. The tunnel facility was designed for studying the aerodynamics of vertical/short takeoff and landing (V/STOL) aircraft configurations. The tunnel facility also is used for low-speed tests to determine high-lift stability and control, aerodynamic performance, rotorcraft acoustics, turboprop performance, and basic wake and flow field surveys (Gentry et al., 1990).

The Langley 14- by 22-Foot Subsonic Tunnel is operational year-round, generally from 7 AM to 11:30 PM. Each test lasts for about 1 to 8 weeks. With a 20 % run time, the facility operates an average of 800 hours per year.

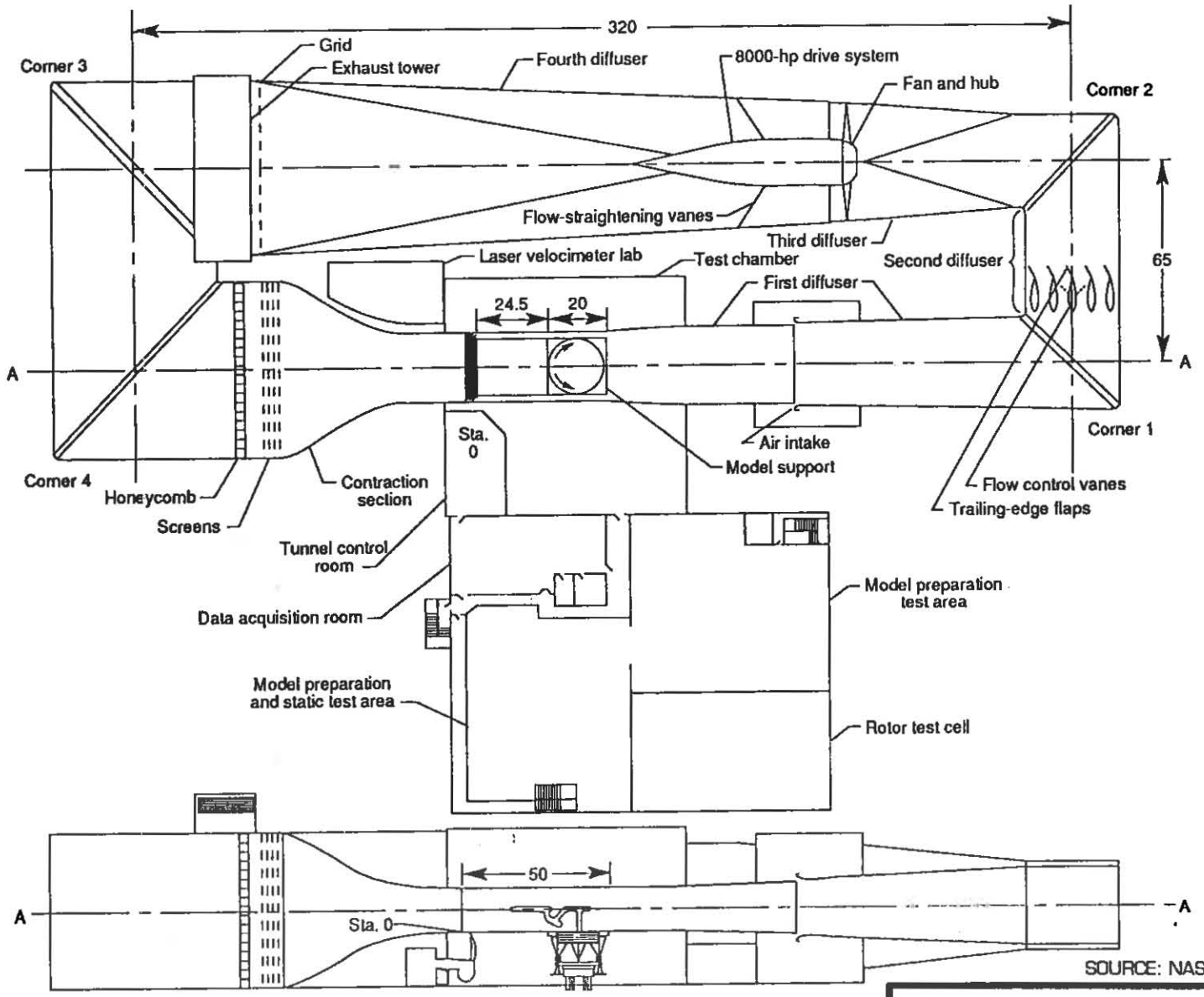
3.2 PROPOSED ACTION

The proposed action consists of providing a new computer-controlled model support system, powered by a 5,000-psi hydraulic system to



LOCATION OF THE 14x22-FOOT SUBSONIC TUNNEL AND COMPONENT SECTION AT NASA LANGLEY RESEARCH CENTER
Hampton, Virginia

FIGURE 1



SOURCE: NASA Technical Paper 3008

SCHEMATIC DRAWING OF THE 14x22-FOOT SUBSONIC TUNNEL AND COMPONENT SECTION AT NASA LANGLEY RESEARCH CENTER
Hampton, Virginia

FIGURE 2

provide vertical velocities up to 15 feet/sec (4.6 meters/sec) and pitch angular rates up to 60 deg/sec. Vertical and pitch motions will be commanded separately or in combination as required by the test program. The complete support system consists of a new vertical post assembly and drive mechanisms, a new model support cart to provide the required system stiffness and impedance, yaw motion, and an 8-foot (2.4-meter) by 8-foot (2.4-meter) moving belt ground plane located ahead of the post in the floor of the cart.

The construction of the cart (at a location elsewhere from the tunnel facility) is planned to start in June 1993. The cart would be brought to the tunnel facility for assembly in July 1993. Assembly would be complete in September 1994, and final check-out would be complete in December 1994. The estimated construction cost for the proposed action is $2.2 million.

It is anticipated that project construction will not interrupt ongoing study activities at the Langley 14- by 22-Foot Subsonic Tunnel. The proposed action consists of adding a new technique to the existing tunnel facility. New electrical connections will be required for the model support system; but, there will be no alteration of the existing tunnel structure. The facility's hours of operation will not be changed. It is estimated that the new model support system will be used at the most two times per year for about 4 to 6 weeks of testing. Completion of the proposed project is not anticipated to result in substantial changes to the operation of the tunnel facility.

3.3 NO-ACTION/NEW-CONSTRUCTION ALTERNATIVES

The alternatives considered in this EA are the proposed action described in the preceding section, the No-Action alternative, and the New-Construction alternative. Inclusion of the No-Action alternative in an environmental analysis is prescribed by the Council on Environmental Quality Regulations Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500 - 1508). The No-Action alternative provides the benchmark against which the proposed action is evaluated. The No-Action alternative will maintain the status quo, and will entail continued use of the Langley 14- by 22-Foot Subsonic Tunnel.

The No-Action alternative will result in no impacts on the environment from either construction or operation; however, this alternative will not result in the needed capability for wind-tunnel investigation of rate-of-descent effects and large-amplitude, high-rate angular motion. The are no facilities available to perform the desired testing. The Langley VRF, a very low-speed, low-productivity facility, which had minimal rate-of-descent testing capability has been moth-balled and is not available for testing.

The New-Construction alternative will entail construction of a new wind tunnel facility capable of supporting the desired investigations. The New-Construction alternative is time-and cost-prohibitive.

4.0 ENVIRONMENTAL IMPACTS

4.1 PROPOSED ACTION

4.1.1 Water Quality

Construction of the proposed action will not impact water quality. The proposed action will not result in sediment or erosion impacts, and will not alter stormwater management at LaRC because it will not require land clearing or ground disturbance, and will not increase the amount of impervious surface at LaRC. The proposed action will not change the quantity or quality of LaRC's domestic wastewater discharge to the Hampton Roads Sanitation District.

4.1.2 Air Quality

Construction of the proposed action will not result in air emissions. The motors at the Langley 14- by 22-Foot Subsonic Tunnel are electric-powered, and do not generate air emissions. The only emission from this facility is the atmospheric air which is exhausted out of the tunnel. The Langley 14- by 22-Foot Subsonic Tunnel does not require a Clean Air Act permit for operation. The proposed action will not result in any new air emissions from this facility.

4.1.3 Biological Resources

The Langley 14- by 22-Foot Subsonic Tunnel is located within the densely developed western area of LaRC. There are no natural habitats in the vicinity of the tunnel facility. Construction of the proposed project will occur within the interior of Building 1212C, and will not require any land clearing. The consequences of the proposed action will not affect any biological resources.

4.1.4 Endangered and Threatened Species

No Federal or state-listed endangered or threatened species are known to occur at LaRC (Letter from the Virginia Department of Conservation and Recreation's Division of Natural Heritage dated 21 January 1993). However, no comprehensive field survey has been performed at LaRC. The proposed action will occur in an industrial area of the LaRC which is devoid of suitable natural habitat, and will be confined to the interior of the existing facility. The consequences of the proposed action will not affect any endangered or threatened species, or their critical habitat.

4.1.5 Waste Generation, Treatment, Storage, and Disposal

Non-hazardous solid waste generated at LaRC is disposed of by burning in the on-site refuse-to-steam plant, or by disposal in an off-site permitted landfill. The proposed action will result in a negligible amount of non-hazardous solid waste, which will be

disposed of in an off-site permitted landfill. The proposed action will not affect the quantity or disposal of solid waste generated due to operation of the Langley 14- by 22-Foot Subsonic Tunnel.

LaRC will require the construction contractor to identify any hazardous wastes which will be generated during construction of the proposed action, and to submit a hazardous waste disposal plan to the Contracting Officer for approval prior to the disposal of such waste. Operation of the Langley 14- by 22-Foot Subsonic Tunnel after the proposed action is complete will not result in the generation of hazardous waste.

4.1.6 Noise

The majority of noise produced during assembly and installation of the proposed new model support system will be contained within the interior of Building 1212C. Only occasional and minor noise levels will be evident outside the building and no other nearby LaRC activities will be impacted. The noise will not be audible at any residential receptors. Installation of the model support system will not alter noise levels produced during operation of the tunnel facility, nor will it substantially increase utilization of the tunnel facility.

4.1.7 Toxic Substances

The Langley 14- by 22-Foot Subsonic Tunnel uses compressed air for cleaning. Materials used during investigations to create smoke in the tunnel are handled in accordance with the provisions of the LaRC Safety Manual (LHB 1710.5). The proposed action will not require the use of additional toxic materials.

4.1.8 Historic, Archeological, and Cultural Factors

The Langley 14- by 22-Foot Subsonic Tunnel has not been surveyed for historical significance. LaRC presently is developing a contract with the National Park Service to survey the West Area standing structures for potential historic significance. NASA has a Programmatic Agreement with the National Conference of State Historic Preservation Officers (SHPO) and the Advisory Council on Historic Preservation (signed 20 September 1989) to streamline consultation and mitigation on projects (e.g., demolition, alteration, new construction) involving National Historic Landmarks.

The proposed action consists of developing and installing a new model support system. The integrity and the function of the existing Langley 14- by 22-Foot Subsonic Tunnel will not be changed as a result of the proposed action. Given the age of the facility (23 years) and the non-disruptive nature of the project, consultation with the SHPO is not necessary. The proposed action will comply with the Programmatic Agreement.

4.1.9 Economic, Population, and Employment Factors

The current work force at the Langley 14- by 22-Foot Subsonic Tunnel is 65 persons. The proposed action will not change the work force at this facility.

4.1.10 Radioactive Materials and Non-ionizing Radiation

Construction of the proposed action will not require the use of radioactive materials or non-ionizing radiation. Lasers are used in the tunnel facility as an instrument to measure wind velocity. Laser use conforms with the requirements of the LaRC Safety Manual (LHB 1710.5).

4.1.11 Wetlands and Floodplains

LaRC has large areas of tidal marsh wetlands associated with Brick Kiln Creek and Tabbs Creek, and small areas of forested wetlands scattered throughout LaRC. The 100-year floodplain at LaRC is at 8.5 feet (2.6 meters) above mean sea level (MSL). There are no wetlands in the vicinity of the Langley 14- by 22-Foot Subsonic Tunnel, and this facility is above the 100-year floodplain elevation. No wetlands or floodplains will be affected by the proposed action.

4.1.12 Coastal Resources Management

LaRC is located within Tidewater Virginia, but by definition is excluded from the boundaries of the Virginia coastal management area. The proposed action will not affect Virginia's coastal resources, and will be consistent with the Virginia Coastal Resources Management Program.

4.1.13 Energy

The Langley 14- by 22-Foot Subsonic Tunnel is a major electricity user, and is covered by the LaRC-wide energy management program for energy conservation and efficient usage. The proposed action may result in a slight increase in the electricity usage of the tunnel facility due to the additional testing.

4.2 NO-ACTION ALTERNATIVE

The No-Action alternative will result in no impacts to the environment from either construction or operation; however, this alternative will not provide the needed capability for wind-tunnel investigation of rate-of-descent effects and large-amplitude, high-rate angular motion.

4.3 NEW-CONSTRUCTION ALTERNATIVE

The New-Construction alternative will require the construction of a new wind tunnel facility to provide the desired investigation capabilities. The New-Construction alternative will be time- and cost-prohibitive.

5.0 REFERENCES

Gentry, G.L., Jr., P. F. Quinto, G.M. Gatlin, and Z.T. Applin. September, 1990. The Langley 14- by 22-Foot Subsonic Tunnel: Description, Flow Characteristics, and Guide For Users. NASA Technical Paper 3008.

NASA. no date. Construction of Facilities FY 1993 Estimates. Modifications to 14- by 22-Foot Subsonic Wind Tunnel (1212C). Long Form Writeups). Langley Research Center; Hampton, Virginia.

NASA. April, 1980. Implementing the Provisions of the National Environmental Policy Act. NHB 8800.11.

NASA/Langley Research Center. March 1992. Langley Research Center Safety Manual. LHB 1710.5.

NASA/Langley Research Center. November 1991. LaRC Environmental Program Manual. LHB 8800.1.

6.0 AGENCIES RECEIVING A COPY OF THE ENVIRONMENTAL ASSESSMENT

Ms. Cindy Schultz
U.S. Department of the Interior, Fish and Wildlife Service
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Whitemarsh, VA 23183

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Office of Public and Intergovernmental Affairs
202 N. 9th Street
Richmond, VA 23219

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Richmond, VA 23230

Mr. John R. Davy
Department of Conservation and Recreation
203 Governor Street
Suite 326
Richmond, VA 23219

Mr. Bruce J. Larson
Department of Historic Resources
221 Governor Street
Richmond, VA 23219

Mr. Robert W. Grabb
Assistant Commissioner
Marine Resources Commission
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Newport News, VA 23607

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Department of Environmental Quality
Air Division
Ninth Street Office Building, (8th Floor)
Richmond, VA 23219

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Chesapeake Bay Local Assistance Department
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Richmond, VA 23219

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Water Division
4900 Cox Road, Innsbrook Corporate Center
Richmond, VA 23230

Mr. Thomas A. Barnard, Jr.
Virginia Institute of Marine Science
Gloucester Point, VA 23062

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Richmond, VA 23219

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Department of Environmental Quality
Waste Division
Monroe Building, 11th Floor
101 North 14th Street
Richmond, VA 23219

Mr. Jack E. Frye
Public Beach Board
P.O. Box 1024
Gloucester Point, VA 23062

Mr. Arthur L. Collins
HR PDC
Regional Building
723 Woodlake Drive
Chesapeake, VA 23220

Mr. Robert J. O'Neill
Hampton City Manager
City Hall
22 Lincoln Street
Hampton, VA 23660

7.0 LIST OF AGENCIES AND PERSONS CONSULTED

Ms. Cindy Schultz
U.S. Fish and Wildlife Service

ENDANGERED SPECIES REVIEW

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

21 January 1993

Dottie Keough
Ebasco
2111 Wilson Blvd. Suite 435
Arlington, Virginia 22201

Re: Resources Management Document for NASA Langley Research Center

Dear Ms. Keough:

In response to your 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 by the Virginia Natural Area Preserves Act as "the habitat of rare, threatened, or endangered plant and animal species, rare or state significant natural communities or geologic sites, and similar features of scientific interest" (sec. 10.1-209 et seq. of the Code of Virginia).

According to the information currently in our files, there are no natural heritage resources documented at the Langley Air Force Base and Langley Research Center. The absence of data does not necessarily mean that natural heritage resources do not exist on or adjacent to the study site, but rather that our files do not currently contain information to document their presence.

To most accurately identify those species with a good potential to occur at the Langley Research Center, I have enclosed lists of natural heritage resources that have been documented on the Poquoson West, Newport News North, and Hampton USGS Quadrangles. All of these resources could occur at Langley in appropriate habitat, however, their presence can only be verified though field surveys. There are no NHR's documented on the Poquoson East Quadrangle.

Due to the delay in responding to your request, I am providing this information to you at no charge. Please note that DNH has recently revised the Information Services provided through

environmental review. An updated fact sheet and order form are included for your reference.

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.

An explanation of species rarity ranks and legal status abbreviations is enclosed for your reference. Thank you for the opportunity to comment on this project.

Sincerely,

Timothy John O'Connell

Timothy J. O'Connell
Environmental Review Coordinator

DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF NATURAL HERITAGE

NATURAL HERITAGE RESOURCES OF POQUOSON WEST QUAD

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
** AMPHIBIANS					
AMBYSTOMA MABEEI	MABEE'S SALAMANDER	G4	S1		LT
AMBYSTOMA TIGRINUM	TIGER SALAMANDER	G5	S1		LE
HYLA GRATIOSA	BARKING TREEFROG	G5	S1		LT
** BIRDS					
ARDEA HERODIAS	GREAT BLUE HERON	G5	S3		
IXOBRYCHUS EXILIS	LEAST BITTERN	G5	S2		
** COMMUNITIES					
COASTAL PLAIN SINKHOLE POND			S1		
ESTUARINE HERBACEOUS VEGETATION					
ESTUARINE SCRUB					
LOW HERBACEOUS WETLAND					
OLIGOTROPHIC SEASONALLY FLOODED WOODLAND					
OLIGOTROPHIC SEMIPERMANENTLY FLOODED WOODLAND					
SUBMESOTROPHIC FOREST					
** MAMMALS					
CONDYLURA CRISTATA PARVA	STAR-NOSED MOLE	G5T4	S2	3C	
** NON-VASCULAR PLANTS					
SPHAGNUM MACROPHYLLUM VAR MACROPHYLLUM	LARGE-LEAF PEATMOSS	G3G4T3	S2		
** VASCULAR PLANTS					
BOLTONIA CAROLINIANA	CAROLINA BOLTONIA	G2Q	S2		
CAREX COLLINSII	COLLINS' SEDGE	G4	S3		
CUSCUTA INDECORA	PRETTY DODDER	G5	S2?		
ELEOCHARIS TENUIS VAR VERRUCOSA	SLENDER SPIKERUSH	G5T3T5	S1		
FIMBRISTYLIS PERPUSILLA	HARPER'S FIMBRISTYLIS	G2	S1	C2	LE
LYTHRUM ALATUM VAR ALATUM	WINGED LOOSESTRIFE	G5T5	S2		
SABATIA CAMPANULATA	SLENDER MARSH PINK	G5	S2		
TILLANDSIA USNEOIDES	SPANISH MOSS	G5	S2		

22 Records Processed

DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF NATURAL HERITAGE

NATURAL HERITAGE RESOURCES OF NEWPORT NEWS NORTH QUAD

SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
** AMPHIBIANS					
AMBYSTOMA MABEEI	MABEE'S SALAMANDER	G4	S1		LT
** VASCULAR PLANTS					
CAREX LUPULIFORMIS	FALSE HOP SEDGE	G3G4Q	S1		
CYPERUS DIANDRUS	UMBRELLA FLATSEDGE	G5	SH		
QUERCUS SHUMARDII	SHUMARD'S OAK	G5	S2		
TRILLIUM PUSILLUM VAR VIRGINIANUM	VIRGINIA LEAST TRILLIUM	G3T2	S2	C2	

5 Records Processed

DEPARTMENT OF CONSERVATION & RECREATION
DIVISION OF NATURAL HERITAGE

NATURAL HERITAGE RESOURCES OF HAMPTON QUAD

	SCIENTIFIC NAME	COMMON NAME	GLOBAL RANK	STATE RANK	FEDERAL STATUS	STATE STATUS
** BIRDS						
	CASMERODIUS ALBUS	GREAT EGRET	G5	SB2SN4		
	CHARADRIUS MELODUS	PIPING PLOVER	G3	S2	LT	LT
	RYNCHOPS NIGER	BLACK SKIMMER	G5	S2		
	STERNA ANTILLARUM	LEAST TERN	G4	S2		
	STERNA HIRUNDO	COMMON TERN	G5	S3		
** INVERTEBRATES						
	CICINDELA DORSALIS DORSALIS	NORTHEASTERN BEACH TIGER BEETLE	G4T2	S2	LT	C
** OTHER						
	CHAMPION TREE					
** VASCULAR PLANTS						
	CAREX PEDUNCULATA	LONGSTALK SEDGE	G5	S2		
	CUSCUTA INDECORA	PRETTY DODDER	G5	S2?		
	DESMODIUM STRICTUM	PINELAND TICK-TREFOIL	G3G4	S2		
	DESMODIUM TENUIFOLIUM	SLIM-LEAF TICK-TREFOIL	G3G4	S2		
	DROSERA BREVIFOLIA	DWARF SUNDEW	G5	S2		
	IVA IMBRICATA	SEA-COAST MARSH-ELDER	G5?	S1S2		

13 Records Processed

Definition of Abbreviations Used on Natural Heritage Resource Lists
of the
Virginia Department of Conservation and Recreation

Natural Heritage Ranks

The following ranks are used by the Virginia Department of Conservation and Recreation to set protection priorities for natural heritage resources. Natural Heritage Resources, or "NHR's," are rare plant and animal species, rare and exemplary natural communities, and significant geologic features. The primary criterion for ranking NHR's is the number of populations or occurrences, i.e. the number of known distinct localities. Also of great importance is the number of individuals in existence at each locality or, if a highly mobile organism (e.g., sea turtles, many birds, and butterflies), the total number of individuals. Other considerations may include the quality of the occurrences, the number of protected occurrences, and threats. However, the emphasis remains on the number of populations or occurrences such that ranks will be an index of known biological rarity.

S1 Extremely rare; usually 5 or fewer populations or occurrences in the state; or may be a few remaining individuals; often especially vulnerable to extirpation.

S2 Very rare; usually between 5 and 20 populations or occurrences; or with many individuals in fewer occurrences; often susceptible to becoming extirpated.

S3 Rare to uncommon; usually between 20 and 100 populations or occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

S4 Common; usually >100 populations or occurrences, but may be fewer with many large populations; may be restricted to only a portion of the state; usually not susceptible to immediate threats.

S5 Very common; demonstrably secure under present conditions.

SA Accidental in the state.

SB# Breeding status of an organism within the state.

SH Historically known from the state, but not verified for an extended period, usually > 15 years; this rank is used primarily when inventory has been attempted recently.

SN# Non-breeding status within the state. Usually applied to winter resident species.

SR Reported without persuasive documentation

SU Status uncertain, often because of low search effort or cryptic nature of the element.

SX Apparently extirpated from the state.

SZ Long distance migrant whose occurrences during migration are too irregular, transitory and/or dispersed to be reliably identified, mapped and protected.

Global ranks are similar, but refer to a species' rarity throughout its total range. Global ranks are denoted with a "G" followed by a character. Note that GA and GN are not used and GX means apparently extinct. A "Q" in a rank indicates that a taxonomic question concerning that species exists. Ranks for subspecies are denoted with a "T". The global and state ranks combined (e.g. G2/S1) give an instant grasp of a species' known rarity.

These ranks should not be interpreted as legal designations.

Federal Legal Status

The Division of Natural Heritage uses the standard abbreviations for Federal endangerment developed by the U.S. Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation.

LE - Listed Endangered
LT - Listed Threatened
PE - Proposed Endangered
PT - Proposed Threatened
C1 - Candidate, category 1
C2 - Candidate, category 2
3A - Former candidate - presumed extinct
3B - Former candidate - not a valid species under current taxonomic understanding
3C - Former candidate - common or well protected
NF - no federal legal status

State Legal Status

The Division of Natural Heritage uses similar abbreviations for State endangerment.

LE - Listed Endangered
LT - Listed Threatened
C - Candidate
PE - Proposed Endangered
PT - Proposed Threatened
NS - no state legal status

For information on the laws pertaining to threatened or endangered species, contact:

U.S. Fish and Wildlife Service for all FEDERALLY listed species
Virginia Department of Agriculture and Consumer Services Plant Protection Bureau for STATE listed plants and insects;
Virginia Department of Game and Inland Fisheries for all other STATE listed animals.

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