FINAL

ENVIRONMENTAL ASSESSMENT NEW TOWN PROJECT AT NASA LANGLEY RESEARCH CENTER, HAMPTON, VIRGINIA

Lead Agency: National Aeronautics and Space Administration (NASA), Langley Research Center (LaRC), Hampton, Virginia

Proposed Action: New Town Project at NASA LaRC

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Abstract: NASA LaRC is proposing a major facility redevelopment effort, referred to as the New Town project. The Proposed Action consists of the construction of five new buildings, the renovation of two existing buildings, and the deconstruction of 22 buildings. The New Town project would be completed in five phases, beginning as early as 2008 and expected to be completed over fifteen years. This effort is intended to modernize the center core of LaRC, better align LaRC's facilities with its future mission requirements, and significantly reduce the Center's infrastructure and operations & maintenance costs. The project would reduce the LaRC facility inventory by approximately 6,351 square meters (68,366 square feet) and create additional green space at the Center. This Environmental Assessment evaluates the environmental impacts of the Proposed Action and the No-Action Alternative. This page intentionally left blank.

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EXECUTIVE SUMMARY

This Environmental Assessment (EA) has been prepared to analyze the potential environmental impacts associated with NASA's proposed redevelopment project at NASA Langley Research Center (LaRC), located in Hampton, Virginia. The New Town project is a major deconstruction, renovation and construction initiative that would provide a new core of flexible, state-of-the-art facilities to support LaRC's evolving mission. The project would include construction of five new facilities, renovation of two existing buildings, and deconstruction of 22 buildings to remove abandoned and unneeded infrastructure. The New Town project would be completed in five phases, beginning as early as 2008 and expected to be completed over fifteen years. The project would modernize the center core of LaRC, better align LaRC's facilities with the future direction of the NASA mission, and significantly reduce the Center's infrastructure and operations and maintenance (O&M) costs.

Purpose and Need

The purpose of the New Town project is to cost effectively and efficiently modernize the Center's core facilities and reduce the Center's infrastructure and O&M costs. The New Town project is necessary in order for LaRC to remain a viable cutting edge research facility. The Center's budget cannot sustain the O&M needs of aging and inefficient infrastructure, and LaRC's research capabilities need to be upgraded and strengthened to successfully support current and future NASA missions. The phased approach of the New Town project, which includes a mix of new construction, renovation and deconstruction, would allow LaRC to realize cost savings while at the same time continuing to perform mission critical research with minimal disruption to the employee work environment.

Summary of Environmental Impacts

This EA analyzes the environmental impacts associated with the Proposed Action and the No-Action alternative. Ten resource categories were evaluated to identify potential environmental impacts. The following provides a summary by resource area:

Land Use

Implementation of the New Town project would be consistent with LaRC's Master Plan and the enforceable policies of the Coastal Zone Management Act (CZMA). The project would result in changes to LaRC's identified functional zones by creating a centralized "downtown campus" area and deconstruction activities would create additional open space. No substantial environmental impacts to land use resources would be expected with the implementation of the Proposed Action. Implementation of the No-Action alternative would result in no change to land use.

Noise

Construction equipment and vehicles would cause temporary increases in noise at the New Town project areas and along traffic corridors. The high noise levels would be intermittent over the 15-year period. The project sites are located in or near highly developed areas of LaRC, where high noise levels generated from aircraft and wind tunnel operations are common. Compared to

existing noise levels, the Proposed Action would have a negligible effect on the noise environment. The No-Action alternative would have no impact on the noise environment.

Cultural Resources

The Proposed Action would result in an adverse effect to LaRC's cultural resources since eight of the affected buildings are potentially eligible for listing in the National Register of Historic Places (National Register) as contributing resources to a proposed historic district, and one of the eight is also potentially eligible for listing in the National Register as an individual resource. However, LaRC plans to minimize the impact by completing mitigation measures documented in a Programmatic Agreement being developed among NASA, the Virginia State Historic Preservation Officer, and the Advisory Council on Historic Preservation. The agreement outlines necessary consultation procedures, documentation, and mitigation measures that LaRC would complete prior to the New Town activities that affect historic resources. Potential mitigation measures could include: artifact salvage and curation; recordation, such as development of a web-based public interpretation plan and intensive surveys following guidelines from the Virginia Department of Historic Resources; and the compilation of photographs, written records, and videotaped interviews with facility researchers. While the resources once removed would be lost, the history of the facilities would be preserved through the mitigation measures. Therefore the impact to cultural resources would be minimized. Implementation of the No-Action alternative would result in no change to LaRC's cultural resources.

Hazardous, Regulated and Solid Waste

All hazardous and regulated waste generated from the New Town activities would be disposed of in accordance with LaRC's waste management procedures and applicable Federal, State, and local regulations. Deconstruction activities would generate a large volume of solid waste, but contractors would be directed to recycle materials to the maximum extent possible. As such, implementation of the Proposed Action would have a negligible impact on the environment resulting from the generation of hazardous, regulated and solid waste. Under the No-Action alternative, there would be no change to LaRC's waste generation activities.

Pollution Prevention

The New Town project would be carried out in accordance with LaRC's principles of pollution prevention (P2), and materials generated from the renovation and deconstruction projects would be recycled to the maximum extent possible. While there would be a temporary increase in solid waste generated from the deconstruction activities, this would be offset by replacing outdated inefficient facilities with sustainably designed buildings. The newly constructed/renovated New Town buildings would conform to the Silver standard established by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. The implementation of the Proposed Action would provide a net long-term benefit to the P2 and Environmental Management System (EMS) goals of the Center and the Agency. Under the No-Action alternative, there would be no change in the quantities of wastes or in the P2 activities at the Center.

Health and Safety

New Town project activities would be carried out by qualified and properly licensed and permitted construction and deconstruction contractors. Contractors performing work at LaRC are required to comply with all applicable safety and health regulations, including requirements from the Occupational Safety and Health Administration (OSHA). Therefore, the Proposed Action would not result in substantial health or safety concerns. Under the No-Action alternative, LaRC personnel would continue to occupy aging facilities and there could be a slight increase in the potential for health and safety issues.

Visual Resources

Implementation of the Proposed Action would involve upgrading and improving the overall campus-like setting of the Center. The New Town core would be characterized by modern facilities in a cohesive and consistent architectural style. Although visual resources in the immediate project areas would be temporarily degraded during implementation, the resulting New Town setting would provide enhanced visual quality. The deconstruction of facilities would remove deteriorated, aging and in some cases unsightly infrastructure from LaRC's landscape and create new open spaces. Therefore, implementation of the Proposed Action would have a long-term positive impact on visual resources at LaRC. Under the No-Action alternative, the infrastructure would continue to deteriorate resulting in a minor negative impact to LaRC's visual resources.

Air Quality

The construction, renovation and deconstruction activities would result in a slight increase in emissions from vehicle/equipment exhaust and from fugitive dust. These effects would be mitigated by using standard control and abatement methods in accordance with Virginia and Environmental Protection Agency (EPA) regulations. The Proposed Action is not subject to the General Conformity Rule of the Clean Air Act because emissions of applicable pollutants would not exceed annual *de minimis* thresholds, nor would they regionally significant. LaRC would ensure that the installation of new equipment or systems resulting in air emissions would comply with Federal and State air pollution requirements, and be added to LaRC's existing air permit as appropriate. Therefore implementation of the Proposed Action would not have a substantial effect on air quality. Under the No-Action alternative, there would be no change in LaRC's impact on air quality.

Water Resources

Soil disturbance during construction, renovation and deconstruction activities would produce a minor and temporary increase in suspended solids in the stormwater discharge, but this would be mitigated by sediment control practices. LaRC's use of erosion and pollution controls would ensure that the Proposed Action would be consistent with the Coastal Zone Management Program. No project activities would take place in LaRC's wetlands or floodplains. LaRC would ensure that all construction activities and new water discharge sources comply with applicable regulations, permits and other requirements. Therefore the New Town project would result in minimal impact to water resources. Under the No-Action alternative, there would be no impact to water resources.

Ecological Resources

No Federal or State-listed threatened or endangered species are known to inhabit LaRC, and it is anticipated that no threatened or endangered species would be adversely affected by the Proposed Action. Disturbance of wildlife resulting from the Proposed Action would be limited to the local project sites, and would be very minor and short-term. There would be a net long-term positive impact to local wildlife and to natural vegetation as removal of the buildings would result in more open green space on LaRC property. Under the No-Action alternative, there would be no impact to LaRC's ecological resources.

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the potential environmental impacts associated with NASA's proposal to undertake the "New Town" redevelopment project at NASA Langley Research Center (LaRC), located in Hampton, Virginia.

This EA was prepared in accordance with the requirements of the National Environmental Policy Act of 1969, as amended (NEPA) (42 United States Code (U.S.C.) 4321 *et. seq.*), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) Parts 1500–1508), NASA's regulations (14 CFR Part 1216 Subpart 1216.3), and NASA Procedural Requirements (NPR) 8580.1, "Implementing the National Environmental Policy Act and Executive Order 12114." Information contained in this EA will be used by NASA and the appropriate regulatory agencies to facilitate the NEPA decision-making process and to determine if the Proposed Action would significantly affect the quality of the natural or human environment. If implementing the Proposed Action is determined to potentially have significant environmental impacts, an Environmental Impact Statement would be prepared. If the implementation of the Proposed Action is determined not to be significant, the NEPA decision-making process would conclude with a Finding of No Significant Impact (FONSI).

Chapter 1 of this EA includes background information, the purpose and need for the Proposed Action, and the planning and scoping actions being performed by LaRC. Chapter 2 includes a description of the Proposed Action, the No-Action alternative, and a description of alternatives not carried forward for consideration in the EA. Chapter 3 describes the existing conditions of various environmental resources in the areas of the Proposed Action and Chapter 4 describes how those resources would be affected by implementation of the Proposed Action and the No-Action alternative. Chapter 5 addresses the cumulative effects of other past, present, and reasonably foreseeable actions that may be implemented in the area of the Proposed Action. Appendices include consultation letters and other correspondence; a Draft Programmatic Agreement; a summary of the Strategic Concept Plan for New Town; a summary of LaRC's Phase I architectural survey; and tables of common metric/British unit conversions. NASA requires that the numeric calculations and figures are in metric units with the English equivalent provided in parenthesis.

1.2 AVAILABLE INFORMATION AND ASSUMPTIONS

This EA is based on the best available information at the time of printing. Sources of information regarding the future New Town concept include strategic and facilities planning reports, Center Master Plan future concepts and strategies, and slide presentations for implementation of New Town. Specific reports include "NASA Langley Research Center: Strategic Concept Plan for New Town," dated July 29, 2005, prepared by Leo Daly/Bolan Smart; and "New Town: Langley Research Center's Revitalization Initiative, Presentation to NASA Headquarters," dated November 16, 2007. The information has been provided by LaRC's New Town Project Manager as well as the Center Master Planner and Facilities Engineering and Maintenance personnel. Since development of the original design concept, changes to the New Town concept have been made to accommodate schedule and budget issues. These changes

include a proposed five-phase approach rather than the original three phases, and construction of five new facilities rather than six. This EA reflects LaRC's most current description of the New Town initiative.

The primary driver for the implementation and schedule of the New Town project is funding availability. While LaRC's annual budget funds the day to day operations at the Center, the funding for special projects such as New Town are provided by NASA Headquarters (HQ). Along with the other nine NASA field Centers and three component facilities, LaRC must seek funding from HQ for special projects. To date, LaRC has received funding from HQ for Phase I of New Town. While the overall schedule for the New Town project is not absolute, the overall concept should remain intact. It is assumed that modifications or changes to the schedule for the Proposed Action would not affect the environmental impact as described in this EA. In the event that major changes are made to the scope of the Proposed Action, LaRC would prepare additional environmental documentation at that time.

Since the Proposed Action is a long-range project that would last at least fifteen years, it is likely that Federal, state, and local regulations and other environmental requirements will evolve over the course of the New Town project. Therefore, it was assumed for the purposes of evaluating the environmental impacts in this EA that LaRC would comply with all environmental requirements that are applicable at the time of the implementation of the Proposed Action. LaRC personnel will continue to monitor Federal, state and local regulations for changes that would require modifications to environmental procedures or operations conducted during the New Town project. For example, in 10-15 years, stormwater permitting requirements for construction projects could be different from those cited in Section 4.9.1, but it is assumed that LaRC would comply with the stormwater permitting requirements that apply at the time of construction.

1.3 PROJECT LOCATION

LaRC is situated near the southern end of the lower Virginia Peninsula, approximately 241 kilometers (km) (150 miles) south of Washington, D.C. and 80 km (50 miles) southeast of Richmond, Virginia. LaRC is located within close proximity to several surface water bodies within the tidal zone of the Chesapeake Bay. The cities of Hampton, Poquoson, Newport News, and York County form a major metropolitan statistical area around LaRC. The Center is comprised of research facilities located in two areas which are approximately 4.8 km (3 miles) apart. The two areas, commonly called the West Area and the East Area, are divided by the runways of Langley Air Force Base (LAFB), the headquarters of the Air Combat Command. The East Area is located on 8 hectares (20 acres) of land leased by NASA from LAFB. This area is the original 1917 portion of LaRC and contains several wind tunnels, research facilities, and administrative offices. The West Area occupies 318 hectares (788 acres) of land and contains the major portion of LaRC with the majority of the facilities located there. Figure 1-1 shows LaRC's regional location and relation to LAFB.



Figure 1-1 – Location of NASA Langley Research Center

1.4 BACKGROUND

In 1917, the War Department purchased land in what is now Hampton, Virginia, for joint use by the Army and the National Advisory Committee for Aeronautics (NACA), the forerunner organization for NASA. The site was designated the Langley Field after Professor Samuel Pierpont Langley, an early pioneer in flight. Congress had created NACA to "supervise and direct the scientific study of the problems of flight" and the Langley Field served as an experimental airfield and proving ground for aircraft. The facility was renamed Langley Memorial Aeronautical Laboratory in 1920 with the dedication of the first wind tunnel. As the organization grew, NACA concentrated mainly on laboratory studies at Langley, gradually shifting from aerodynamic research to military rocketry. As the Cold War brought an increasing priority to missile development, major NACA contributions to the military missile programs came in the mid 1950's.

In 1958, as a result of the escalating space race, President Eisenhower signed the National Aeronautics and Space Act establishing the National Aeronautics and Space Administration (NASA). NASA absorbed the NACA intact: its 8,000 employees, an annual budget of \$100 million, the Langley, Ames and Lewis laboratories and two smaller test facilities. Langley Laboratory, which was then officially designated Langley Research Center, was the largest of the new agency's field Centers, with 3,368 government employees. NASA quickly incorporated other organizations and eventually created ten research and spaceflight Centers located around the United States.

Over the years, LaRC has made significant contributions to NASA's mission. Research performed at LaRC in the 1950's and 1960's helped aircraft break the sound barrier and played a major role in helping Americans reach the moon. In the 1970's, research at the Center focused on aircraft design to cut emissions and noise, and on testing space shuttle concepts. In the 1980's, triggered by the Cold War, LaRC and its complex of over 20 wind tunnels performed critical military aircraft research. From the 1980's to the present, LaRC has continued to provide research support and technological advances in aerospace systems concepts and analysis; aerodynamics, aerothermodynamics, and acoustics; structures and materials; airborne systems; and atmospheric sciences. The majority of LaRC's work has been in aeronautics. Once the largest NASA Center, LaRC is now the fifth largest NASA Center.

Agency-wide, NASA continually evaluates its resources and infrastructure in order to align its capabilities to meet the Agency's evolving mission. NASA has recently undertaken a monumental transformation in both business practices and mission. In 2004, President George W. Bush announced a new exploration initiative (the Vision for Space Exploration) to return humans to the moon by 2020 in preparation for human exploration of Mars and beyond. The Vision for Space Exploration includes the development of the Orion crew exploration vehicle and Ares 1 launch vehicle. LaRC's contribution to the project will include acting as the lead on the Launch Abort System integration project. The new mission brings not only technical but also financial challenges to the Agency and its field Centers, as planners strive to best allocate and utilize limited funding.

1.5 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the New Town project is to cost-effectively and efficiently modernize the Center's core facilities and reduce the Center's infrastructure and operations and maintenance (O&M) costs. The New Town project is necessary in order for LaRC to remain a viable cutting edge research facility. The Center's budget cannot sustain O&M needs of aging and inefficient infrastructure, and the Center's research capabilities need to be upgraded and strengthened to successfully support current and future NASA missions. The phased approach of the New Town project, which includes a mix of new construction, renovation and deconstruction, would allow LaRC to realize cost savings while at the same time continuing to perform mission critical research with minimal disruption to the employee work environment.

1.6 CONSULTATION, PLANNING AND SCOPING ACTIONS

Initial concept planning for the New Town initiative began in 2003. Since that time LaRC managers have periodically communicated LaRC's upcoming redevelopment plans with local officials from the cities of Hampton and Poquoson, as well as local business planning personnel.

In addition LaRC personnel have worked regularly with the NASA Headquarters funding, planning and engineering managers during the evolution of the New Town project from the conceptual design phase. Once the New Town design had been finalized, including the specific facilities identified for deconstruction and renovation, LaRC personnel began more formal consultation and scoping activities with regulatory authorities and local agencies and groups.

Due to the age of the infrastructure to be affected by the Proposed Action and NASA's responsibilities under the National Historic Preservation Act of 1966, as amended (NHPA) (16 U.S.C. 470 *et. seq.*), LaRC's consultation actions have mostly involved working with the Virginia State Historic Preservation Officer (SHPO) in the Virginia Department of Historic Resources. In August of 2004, LaRC held an on-site consultation meeting with the Virginia SHPO to discuss various LaRC initiatives including the proposed New Town project. To clarify the potential impact of the project on the as-built environment at the Center, the SHPO recommended that LaRC perform a survey of facilities not previously surveyed or evaluated for eligibility for listing in the National Register of Historic Places (National Register). The survey would provide the baseline information for LaRC to develop a Center-wide Programmatic Agreement with the SHPO and the Advisory Council on Historic Preservation for avoiding or mitigating impacts to historical resources when pursuing projects such as New Town. A copy of the SHPO's comment letter is included in <u>Appendix A</u>. Following the SHPO's recommendation, LaRC completed a Phase I architectural survey of properties 45 years or older. The survey is discussed in Section 3.3.1.

On November 4, 2005, LaRC sent a Letter to Potentially Concerned Agencies (LTPCA) (included in <u>Appendix A</u>) to several groups and organizations that may have concerns regarding the proposed New Town project. The letter provided some basic information regarding the project and a LaRC point of contact for submitting comments or questions. The LTPCA was sent to the following organizations:

- Virginia Department of Environmental Quality (DEQ)
- City of Hampton
- Hampton Roads Planning District Commission
- City of Poquoson
- Virginia Air and Space Center
- Virginia Department of Historic Resources
- Langley Air Force Base

LaRC received response letters from Virginia DEQ, Langley Air Force Base and VDHR. These responses are included in <u>Appendix A</u>.

On November 29, 2006 LaRC held another on-site consultation meeting with the Virginia SHPO to continue discussions regarding activities at the Center and the proposed plans for the future. LaRC and the SHPO discussed the progress toward completing the Phase I architectural survey and clarified plans for developing a Programmatic Agreement to address the New Town activities. LaRC will continue consultation with the SHPO and the Advisory Council on Historic Preservation regarding the Programmatic Agreement, which is expected to be completed by the early fall of 2008. The Draft Programmatic Agreement included in <u>Appendix B</u>.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 PROPOSED ACTION

The Proposed Action, known as the New Town project, would be a major renovation and upgrade initiative at LaRC. The project would include the construction of five new buildings, the renovation of two existing buildings, and the deconstruction of 22 abandoned and unneeded buildings. The New Town project would be completed in five phases, beginning as early as 2008 and expected to be completed over fifteen years. The project would modernize the center core of LaRC, better align LaRC's capabilities with the future direction of the NASA mission, and significantly reduce the Center's O&M costs. New Town would result in a reduction of LaRC's total building inventory by approximately 6,351 square meters (68,366 square feet) and the creation of additional green space at the Center. The initiative would improve flexibility with standardized office spaces and reconfigurable laboratories and provide a visible sign of LaRC's revitalization effort.

The New Town project would consist of facility construction, renovation and deconstruction as described below and displayed in Figure 2-1 and Table 2-1.

Facility Construction

New construction associated with New Town would total approximately 36,600 square meters (393,900 square feet) and consist of the following:

- Two new laboratory buildings:
 - A Laboratory Facility in the area adjacent to the Center's main gate would house the material evaluation and non-destructive evaluation testing labs.
 - A Combined Laboratory Facility to include laser, sensor and instrument development labs would be constructed near the former location of the cafeteria.
- Two new administrative buildings:
 - An Administrative Facility would be constructed in the triangular green space in front of Building 1194, the LaRC technical library.
 - A slightly smaller Administrative Facility would be constructed adjacent to Building 1219, the LaRC Headquarters building.
- One Shared Space Facility:
 - The new Shared Space Facility would include LaRC's cafeteria, conference center space, and health club facilities.

Facility Renovation

The New Town renovation efforts would consist of rehabilitating the following buildings:

- Building 1219 (3,337 square meters (35,919 square feet)), LaRC's Headquarters building
- Portions of Building 1230 (8,471 square meters) (91,183 square feet)), a research complex containing office and laboratory space

Facility Deconstruction

The New Town project would include the deconstruction (i.e. complete removal) of 22 buildings (listed in Table 2-1) totaling 42,937 square meters (462,186 square feet) of facility inventory. These facilities include office complexes, research laboratories, conference centers and various other buildings. All facilities would be removed down to and including slabs and foundations. Utilities would be capped below grade, and the property regraded to match existing site contours.

Final Environmental Assessment for the New Town Project



Figure 2-1 – Proposed New Town Project

Proposed Action	Building Number	Building Description	Square Meters	Square Feet	Years Occupied
Construction	-	Laboratory Facility	3,715	39,990	-
Construction	_	Combined Laboratory Facility	8.269	89.010	_
Construction	_	Administrative Facility	10,590	114,000	-
Construction	_	Administrative Facility	9,380	101,000	_
Construction	-	Shared Space Facility	4,645	50,000	-
Renovation	1219	LaRC Headquarters	3,337	35,919	63
Renovation	1230	1230 Research Complex	8,471	91,183	62
Deconstruction	1149	Inspector General/ Medical Center	940	10,122	67
Deconstruction	1151	Office Facility	463	4,986	37
Deconstruction	1152	Office Facility/Publications	2,799	30,132	67
Deconstruction	1153	Training Classrooms	722	7,769	67
Deconstruction	1192	Office Complex	1,226	13,194	66
Deconstruction	1192C	Office Complex	1,418	15,266	42
Deconstruction	1192D	Office Complex	523	5,627	66
Deconstruction	1192E	Office Complex	966	10,403	36
Deconstruction	1195	Office Complex	1,720	18,511	14
Deconstruction	1195A	Office Complex	1,843	19,840	42
Deconstruction	1195B	Office Complex	991	10,666	36
Deconstruction	1195C	Office Complex	1,102	11,861	31
Deconstruction	1200	Research Complex	2,587	27,842	43
Deconstruction	1200A	Research Complex	64	693	43
Deconstruction	1202	Research Lab	7,945	85,523	43
Deconstruction	1202A	Pearl Young Conference Center	1,487	16,008	15
Deconstruction	1209	Office Facility	6,270	67,489	32
Deconstruction	1213	Cafeteria/Exchange Shop	2,512	27,037	63
Deconstruction	1222	H.J.E. Reid Conference Center	1,803	19,412	62
Deconstruction	1229	Office Facility	3,774	40,624	63
Deconstruction	1238	1238 Complex	1,091	11,743	33
Deconstruction	1238A	1238 Complex	691	7,438	30

Table 2-1. Buildings Proposed for Construction, Renovation and Deconstruction

The New Town project would employ sustainable design principles and comply with sustainability standards mandated by Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* and other Federal requirements. New Town building construction and renovation would meet at least the Silver standard established by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System, which is discussed in Section 4.5.1.

Construction in the New Town development would be concentrated in a central core area, which would become predominantly pedestrian with the exception of parking lots. In order to ensure

that New Town would be consistent with already established campus scale, new buildings would vary from two to five stories. The existing pedestrian spine would be reinforced and expanded. An uninterrupted sequence of large open spaces would be created along the pedestrian area, filled predominantly with landscaping trees (mostly existing) and some paving. New trees would screen parking lots from the pedestrian spine.

Additional information regarding the New Town background, justification and preliminary design concept are described in the *Strategic Concept Plan for New Town* (Appendix C). However, certain details of the New Town project, including specific buildings proposed for construction, renovation and deconstruction, may have changed since this document was published in July of 2005.

2.2 NO-ACTION ALTERNATIVE

Under the No-Action alternative, LaRC would not undertake the New Town project. The Center would continue to operate and maintain the buildings that are currently in use at the Center. Many facilities would remain abandoned or underutilized. The No-Action alternative would not facilitate LaRC's goal of improving current and future mission performance capability. The No-Action alternative would forego the opportunity to streamline the Center's infrastructure and to refocus limited resources on the infrastructure that would meet LaRC's mission requirements. The No-Action alternative could potentially compromise the Center's research capabilities as limited resources would be spent to sustain aging and inefficient infrastructure.

2.3 ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

In 2004, as part of the initial conceptual planning stages for improving LaRC's capabilities, LaRC prepared a *Facilities Plan: Needs Assessment and Investment Options* report. The assessment evaluated existing building conditions and inventory and approaches to improve the facilities. The report also factored in mission operational considerations and the direct and indirect cost/benefits of operational and/or building consolidations. The assessment evaluated the following five possible occupancy options to determine if cost savings could be realized over a 25-year period beginning in 2007:

- 1. Maintain Status Quo
- 2. Rehabilitate Existing Facilities
- 3. Demolish and Construct New Facilities
- 4. Implement Prototype Scenario (combination of Options 2 and 3)
- 5. Lease Private Sector Space Off LaRC's Campus

Options 1 and 4 are included in this EA. Option 1 represents the No-Action Alternative, and Option 4 is the Proposed Action. The other three options were eliminated from further consideration in this EA as they would not meet the purpose and need of the Proposed Action, as described below:

Option 2 (rehabilitation of existing facilities) would not meet the Center's identified needs, because most of the existing buildings are poorly suited as candidates for rehabilitation. Many of the facilities would have to be "virtually demolished" during rehabilitation because the major systems and layout of the facilities are outdated and inefficient. The costs and payback period

for rehabilitation of existing facilities, in addition to the potential displacement and disruption to employees resulted in this option being eliminated from further consideration.

Option 3 (complete demolition and construction of new facilities) was evaluated and determined not to meet the need to cost effectively and efficiently modernize LaRC's core. This option would result in a much higher cost, and could disrupt and displace employees.

Option 5 (lease of private sector space off campus) was eliminated from further consideration as it did not meet the Center's needs. This option would neither modernize the Center, nor reduce the Center's infrastructure and O&M costs. It would actually result in a fragmentation of the Center's core.

3.0 AFFECTED ENVIRONMENT

This chapter describes relevant environmental conditions at LaRC for resources potentially affected by the Proposed Action and the No-Action alternative described in Chapter 2.0. In compliance with guidelines contained in NEPA and CEQ regulations and NPR 8580.1, the description of the existing environment focuses on those environmental resources potentially subject to impacts. The environment includes all areas and lands that might be affected, as well as the natural, cultural, and socioeconomic resources they contain or support.

Resources Eliminated From Detailed Consideration

Several resources were not evaluated in this EA because it was determined unlikely that implementation of either the Proposed Action or the No-Action alternative would have any impact on these areas of concern. A brief explanation of the reasons why each resource has been eliminated from further consideration in this EA is provided below.

Virginia Coastal Zone Programs. The following Virginia DEQ enforceable programs and policies are not applicable to the Proposed Action as the construction, renovation and deconstruction activities would not have any effect on the resources. Additionally, the No-Action alternative would not have any effect on the resources. The programs and policies include:

<u>Fisheries Management.</u> The Proposed Action would have no effect on the conservation and enhancement of finfish and shellfish resources or the promotion of commercial and recreational fisheries.

<u>Subaqueous Lands Management</u>. The Proposed Action would not involve encroachment into, on or over state-owned subaqueous lands.

<u>Dunes Management.</u> There are no sand covered beaches or sand dunes in the vicinity of the Proposed Action.

Shoreline Sanitation. The Proposed Action would have no effect on shoreline sanitation.

Other Virginia Coastal Zone Program areas that are applicable to the Proposed Action are addressed in Chapters 3 and 4.

Soils and Geology. The construction, renovation and deconstruction activities would involve existing structures and previously developed areas. There would be minimal ground disturbance to remove pile caps, foundations and slab sections during deconstruction and the areas would be backfilled and graded to match existing surroundings. Since implementation of either the Proposed Action or the No-Action alternative would have a negligible effect on soils and geology, these resources were eliminated from further analysis.

Socioeconomic. The No-Action alternative would have no effect on the socioeconomic character of the communities surrounding LaRC. The Proposed Action would occur over a period of fifteen years. There would be no change in the number of NASA employees as a result of the Proposed Action. The construction, renovation and deconstruction work would be performed by contractors from the regional work force or from elsewhere in Virginia. There is a sufficient

pool of local workers to accomplish these tasks in the anticipated timeframe. Because these are temporary jobs that would be filled by the existing regional work force, there would be no effect on area population or increase in the demand for housing or public services in the region. Therefore, the Proposed Action would have a negligible effect on the socioeconomic character of the surrounding communities, and this resource was eliminated from further analysis.

Climate. Climate is the prevalent long-term weather conditions in a particular area. Climatic elements include precipitation, temperature, humidity, sunshine and wind velocity and other natural occurrences such as fog, frost, and hail storms. Implementation of either the Proposed Action or the No-Action alternative would have no measurable effect on the local climate and as such, this resource was eliminated from further analysis.

Environmental Justice. Low-income populations and minority populations that are subject to environmental justice considerations are not located within or near the location of the Proposed Action. Since implementation of either the Proposed Action or the No-Action alternative would not have disproportionately high or adverse human health or environmental effects on low-income populations or minority populations, this resource was eliminated from further analysis.

Wild and Scenic Rivers. None of the waterways within the LaRC property qualify for the provisions of the Wild and Scenic Rivers Act, therefore, analysis of this resource was not carried forward in this EA.

Transportation. Implementation of the Proposed Action would not change the use of transportation resources in the region. Local highways currently accommodate the traffic generated by LaRC employees and other individuals traveling the roads on a daily basis. Transportation of the construction and deconstruction materials would be along an established haul route leading off the Center. The increase in truck traffic would be minimal because the New Town activities would be phased over time. Implementation of the No-Action alternative would not affect transportation resources. Therefore, this resource was eliminated from further analysis.

Since LaRC does not have any *prime or unique farmland* or *conservation areas*, these resources were also eliminated from further analysis.

3.1 LAND USE

Coastal Zone Management Act

LaRC is located within the coastal zone of the Commonwealth of Virginia. Federal agency activities within the coastal zone must be carried out in a manner that is consistent to the maximum extent practicable with the applicable enforceable policies. All Federal actions are subject to this consistency requirement if they would affect natural resources, land uses, or water uses in the coastal zone. The Virginia DEQ oversees activities in the coastal zone of the State through a number of enforceable programs. In reviewing the Proposed Action, DEQ may require agencies to coordinate with its specific divisions or other agencies for consultation or to obtain permits; they also may comment on environmental impacts and mitigation. Virginia DEQ enforceable programs and policies pertain to: Fisheries Management, Subaqueous Lands Management, Tidal and Nontidal Wetlands Management, Dunes Management, Non-Point Source Pollution Control, Point Source Pollution Control, Shoreline Sanitation, Air Pollution Control,

and Coastal Lands Management. Not all of these enforceable programs are applicable to the Proposed Action, as explained in Section 3.0. The remaining programs (coastal lands management, air pollution control, non-point source pollution control, point source pollution control, and wetlands) are discussed in relevant resource sections (e.g., air quality and water resources).

The Coastal Lands Management program regulates activities in the Chesapeake Bay Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). RPAs include tidal shores, tidal wetlands, and non-tidal wetlands that are contiguous to and connected by surface flow to tidal wetlands and perennial streams, and a 30-meter (100-foot) buffer located landward of these features. RMAs include floodplains, highly erodible soils, highly permeable soils, steep slopes, and areas 30 meters (100 feet) landward of an RPA. Both RMA and RPA features exist on LaRC property, but the areas of the Proposed Action are not located within RPAs or RMAs.

Functional Zones

Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive areas. LaRC has a current Center Master Plan (CMP) that supports the Center's strategic approach to programmatic facility planning and prioritization. The CMP identifies the following functional zones (shown in Figure 3-1):

Administration - The LaRC administrative core, which contains the Center's Headquarters building, is distinguishable by its executive character. Facilities affected by the Proposed Action that are located in this zone are: Buildings 1195, 1195A, 1195B, 1195C, and 1219.

Center Operations and *Services* - Most of the Center's oldest assets and most dense development are included in these areas. This heavy traffic zone either borders or embraces Langley Boulevard, the primary Center traffic artery. These zones include the following facilities affected by the Proposed Action: Buildings 1149, 1152, 1153, 1213, 1222, 1229, 1230, and 1238.

Labs and *Science* - Labs are located in two main areas on either side of Langley Boulevard. Science offices are grouped along Dryden Avenue. Buildings 1151, 1192, 1192C, 1192D, 1192E, 1202, 1202A, 1209, and 1238A are located in these zones.

Tunnels and Testing - LaRC's large-scale tunnels are contained in this zone. These large tunnel complexes along the property boundary form a compact and strongly related functional grouping. The zone is characterized by noisy exhausts, vibration, and the remote, well-regulated potential for uncontrolled energy release. This zone includes Buildings 1200 and 1200A.

Aeronautics - This area contains the aircraft hangar and associated site improvements and required open space. Considerable undeveloped land area exists here and is strictly utilized for functions directly connected to the hangar and flight line operations. No New Town activities would occur in this zone.

Outreach - Outreach offices include training facilities, student programs, the offices of public affairs, legislative affairs, news media, and affiliated universities/institutions. No New Town activities would occur in this zone.



Figure 3-1 – LaRC Functional Zones

Back 40 – This area includes approximately 89 hectares (220 acres) of largely undeveloped land. Various small facilities and structures are scattered throughout the area, many of which have been abandoned. No New Town activities would occur in this area.

Vegetation Buffer - Undeveloped areas are maintained as vegetation buffers along some portions of the LaRC fence line. No New Town activity would occur in this area.

The proposed New Town construction would occur in the following functional zones: Labs, Center Operations, Administration and Services.

3.2 NOISE

The fighter aircraft operating from LAFB are by far the dominant and most widespread noise source in the area. The Noise Contour Map (Figure 3-2) was derived from the Air Installations Compatible Use Zone report prepared by LAFB. The decibel (dBA) contours on the map are calculated using the "Ldn" parameter, which is preferred by the EPA for assessing environmental noise impacts. It accounts for all the noise occurring throughout the 24-hour day but with a 10-decibel penalty added to the nighttime hours to account for people's greater sensitivity to noise at night. Ldn levels up to 65 dBA are generally considered acceptable for residences. The New Town core area where the new construction would occur is located in the 70 dBA noise contour zone. Most of the buildings proposed for deconstruction/renovation are also located in the 70 dBA noise zone. Three buildings to be deconstructed (Building 1209 and 1202, 1202A) are located in the 65 dBA.

Primary noises generated at LaRC itself include the wind tunnels, the compressor stations, and the substations. Most of the wind tunnels are closed-loop tunnels in which the test gas medium is re-circulated and the noise generated by the tunnel is contained largely within the building. Noise level surveys conducted on the various wind tunnels during peak operating mode have identified noise levels ranging from 45 to 80 dBA. The daily operation of motor vehicles in and around LaRC is considered a minor source of noise.

Although Virginia does not have noise control regulations, the City of Hampton has enacted a Noise Ordinance (Hampton City Code, Section 22) which prohibits creating any unreasonably loud or disturbing noise of such character, intensity, or duration that may be detrimental to the life or health of any individual or which disturbs the public peace and welfare. LaRC's Industrial Hygiene staff monitors noise levels both inside and outside of the Center facilities to ensure excessive noise does not harm human health or the environment. In addition, the Industrial Hygiene staff ensures proper controls are in place to protect Center personnel from exposure to excessive noise levels in accordance with Occupational Safety and Health Administration (OSHA) requirements.



Figure 3-2 – LaRC Noise Contours

3.3 CULTURAL RESOURCES

Cultural resources are any prehistoric or historic district, site, building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or other purposes. They include archaeological resources, traditional resources, and historic architectural resources. Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Historic architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Historic properties (as defined in 36 CFR 60.4) are significant archaeological, architectural, or traditional resources that are either eligible for listing, or listed in, the National Register.

The management of cultural resources is primarily regulated by the National Historic Preservation Act (NHPA). Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. Impacts to cultural resources may be considered adverse if the resources have been determined to be eligible for listing in the National Register. Section 110 of the NHPA advocates proactive management of resources through the incorporation of historic preservation into the comprehensive plans of agencies, facilities, or programs. The act requires agencies to compile cultural resource inventories which should be integrated into systems for property administration, land use planning and project planning.

LaRC has a Cultural Resource Management Plan (CRMP) that contains information on LaRC's historic background, cultural resources and historic properties. It provides information on cultural resource surveys and investigations that have been performed at the Center and the types of LaRC activities that may affect cultural resources. The CRMP also provides information and guidelines necessary for proper preservation and management of LaRC's cultural resources and historic properties. Although oversight of the cultural resource program at LaRC is primarily the responsibility of LaRC's Historic Preservation Officer (HPO), all persons involved in project planning and implementation at the Center also have a responsibility to be aware of the cultural resource management goals of both NASA and LaRC, and to see that NASA complies with the pertinent historic preservation laws and regulations. Sections of LaRC's CRMP are integrated with the Center's Master Plan and Geographic Information System (GIS) database in order to facilitate project planning and ensure historic preservation issues are addressed in project planning at the Center.

3.3.1 Architectural Resources

LaRC has five properties that are National Historic Landmarks (NHLs): the Variable Density Tunnel, the 8-Foot High Speed Tunnel (Building 641), the Full Scale Tunnel (Building 643), the Rendezvous Docking Simulator, and the Lunar Lander Facility (Building 1297). These properties were identified during a 1985 survey performed by the National Park Service as part of the "Man in Space" theme study. The wind tunnels provided the technological base from which the early space program was initiated, and the training facilities played an important role in preparing astronauts to operate in space and land on the moon.

LaRC recently completed a Phase I reconnaissance level survey of 164 architectural resources. The results of the survey are summarized in <u>Appendix C</u>. The survey identified that most of LaRC's architectural resources are not individually eligible for the National Register. Many are, however, potentially eligible as contributing resources to a proposed LaRC Historic District. The proposed district is discontiguous, consisting of four defined significant areas separated by non-significant areas. Two areas are located in LaRC's West Area, and two are located in LaRC's East Area.

The core of New Town, which includes the proposed facility construction sites, is located within the main NASA LaRC Historic District. Figure 3-3 shows the location of the New Town project in relation to LaRC's West Area Historic District boundaries. As evident in the map, most of the buildings proposed for deconstruction/renovation are within the proposed Historic District, with the exception of Buildings 1200, 1200A, 1202, 1202A, 1209 and 1222. Table 3-1 below provides the historic status for each facility that would be affected by the New Town project.

Eight of the buildings that would be affected by the New Town project are potentially eligible for listing in the National Register as contributing resources to a proposed historic district. One of these eight facilities, Building 1219 (LaRC Headquarters), is also potentially eligible for the National Register as an individual resource.

3.3.2 Archaeological Resources

Since the mid-1970s, LaRC has conducted eleven archaeological surveys, which have identified more than 20 archaeological sites located throughout LaRC. Native American artifacts have been discovered as well as the remains of colonial and early American plantations. One of the sites, known as the Chesterville Plantation, is listed in the National Register, as it was the birthplace of George Wythe, an original signer of the Declaration of Independence. The site has been preserved in place. At least ten other archaeological sites are potentially eligible for listing in the National Register. These sites would require additional survey work if any future LaRC activity involving ground disturbance were planned at or near any of the sites.

Only one of the buildings affected by the proposed New Town project is located within close proximity to an archeological resource. Building 1222, the H.J.E. Reid Conference Center, is approximately 10 meters (33 feet) west of Site 44HT45 (Cloverdale Plantation). This site is potentially eligible for the National Register and preserved in place. Both prehistoric and historic artifacts have been recovered from this location.

Because the soils beneath and surrounding existing buildings have experienced significant ground disturbance during facility construction and operations, undisturbed archaeological resources are not anticipated in areas of existing buildings.

3.3.3 Traditional Resources

Several State-recognized tribes reside in eastern Virginia; however, American Indian traditional resources have not been identified at LaRC.

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Figure 3-3 – Proposed LaRC West Area Historic Districts

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Building Number	Name of Building	Year Built	Proposed Action	Status*
1149	Dispensary Office of Patent Counsel	1941	Deconstruction	Contributing
1151	Management Support	1971	Deconstruction	Noncontributing
1152	Publications Editorial Office	1941	Deconstruction	Contributing
1153	External Affairs	1941	Deconstruction	Contributing
1192	Financial Management Division	1942	Deconstruction	Contributing
1192C	Impact Basin Office Building	1942	Deconstruction	Noncontributing
1192D	Projects Directorate	1966	Deconstruction	Noncontributing
1192E	Scout Project Office	1966	Deconstruction	Noncontributing
1195	Financial Management and Procurement Building	1966	Deconstruction	Noncontributing
1195A	Fiscal & Procurement Building Annex	1966	Deconstruction	Noncontributing
1195B	Fin. Management Division, U.S. Army Lab	1972	Deconstruction	Noncontributing
1195C	Administrative Management Building	1977	Deconstruction	Noncontributing
1200	Laser Optics Laboratory	1965	Deconstruction	Noncontributing
1200A	Research Support	1965	Deconstruction	Noncontributing
1202	Research Lab	1965	Deconstruction	Not Surveyed
1202A	Pearl Young Conference Center	1993	Deconstruction	Not Surveyed
1209	Office Facility	1976	Deconstruction	Not Surveyed
1213	Cafeteria Telephone Exchange	1946	Deconstruction	Contributing
1219	Langley Research Center Headquarters	1945	Renovation	Individually Eligible and Contributing
1222	Employee Activities Conference Center	1946	Deconstruction	Noncontributing
1229	Loads, Structures, & Dynamics Research	1945	Deconstruction	Contributing
1230	Instrumentation Research	1945	Renovation	Contributing
1238	Laser/Optics Lab	1975	Deconstruction	Noncontributing
1238A	Composite Model & Metal Finishing Shop	1978	Deconstruction	Noncontributing

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*Status

Contributing – identified as potentially eligible for listing in the National Register as a contributing resource to the proposed historic district

Individually and Contributing – identified as potentially eligible for listing in the National Register as both an individual resource and as a contributing element to the proposed historic district

Noncontributing - determined to be a non-contributing resource

Not Surveyed – due to the age, location and type of structure, the facility was not included in the Architectural Survey, however LaRC has determined that the facility is not an historic property

3.4 HAZARDOUS, REGULATED AND SOLID WASTE

LaRC has established a pollution prevention policy with the goal of minimizing the volume and toxicity of wastes generated at the Center to the extent technically and economically feasible. Source reduction, recycling, recovery and reuse are utilized whenever possible.

Hazardous wastes generated at LaRC are managed and disposed of according to established Center policies and applicable laws and regulations. LaRC is considered a large quantity generator of hazardous waste. The Center is not authorized to transport hazardous waste off-site, store hazardous waste beyond a 90-day accumulation period, or treat or dispose of hazardous waste on site. The hazardous and regulated wastes generated at LaRC include of a wide variety of items, such as solvents, fuels, oils, gases, batteries, fluorescent light bulbs and laboratory chemicals. Waste generated from remediation projects such as paint removal and spill cleanup are sampled and analyzed to ensure proper waste characterization and disposal. Any materials that contain hazardous waste or exhibit hazardous characteristics are transported by an appropriately permitted contractor to a permitted hazardous waste disposal facility.

LaRC ensures the proper management and disposal of materials containing polychlorinated biphenyls (PCBs) or asbestos. All large transformers at the Center that contained PCBs have been retrofilled or removed. Many of the older facilities at the Center still have small PCB light ballasts or capacitors. LaRC ensures that PCB materials are properly packaged, transported and disposed of at an approved disposal facility. Similar requirements apply for the management of Asbestos Containing Materials (ACM). ACM has been identified in the following facilities affected by the Proposed Action: Buildings 1149, 1151, 1152, 1192, 1192C, 1192D, 1195A, 1200, 1202, 1209, 1213, 1219, 1222, 1229, 1230, 1238, and 1238A. All contractors performing asbestos work at LaRC must be appropriately licensed, and the waste must be properly packaged, labeled and transported to a permitted landfill.

NASA LaRC has one remediation site on the National Priorities List under the Comprehensive Environmental Responsibility Compensation and Liability Act (CERCLA). This site is a Construction Debris Landfill located in the northern part of the Center. No activities associated with the Proposed Action would occur near this site.

LaRC maintains an Integrated Spill Contingency Plan that provides information on applicable regulatory requirements and procedures related to oil and hazardous material spill control at LaRC. In addition it documents the policies and procedures regarding the management of underground and aboveground storage tanks. The following storage tanks would be affected by the Proposed Action:

- A 1135-liter (300-gallon) used cooking oil/grease aboveground storage tank at Building 1213
- A 757-liter (200-gallon) aboveground storage tank containing No. 2 fuel oil used for an emergency generator at Building 1213
- A 757-liter (200-gallon) used cooking oil/grease aboveground storage tank at Building 1222

No underground storage tanks are present at the facilities affected by the Proposed Action.

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LaRC generates large volumes of municipal solid waste. The major items are paper, wood, metals, cardboard, plastics, grass and tree clippings, glass, and maintenance wastes. LaRC recycles white and mixed paper, cardboard, toner cartridges, plastic bottles, aluminum cans, scrap metal, used oil, batteries, fluorescent light bulbs, and used tires. Non-hazardous, non-regulated, solid materials that are not collected for recycling are consolidated and transported for disposal to a local landfill or for energy recovery at Hampton's Refuse-Fired Steam Generating Facility.

3.5 POLLUTION PREVENTION

Pollution prevention (P2) is a multimedia approach to environmental management based on the priorities outlined in the Pollution Prevention Act of 1990. When applying P2 methodologies to LaRC activities (e.g. operations generating air emissions, wastewater, or solid/hazardous waste), priority is given to the use of source reduction techniques. Source reduction is the prevention of waste generation through process modifications or material substitutions. Where source reduction is not feasible, other environmentally preferable methods such as reuse or recycling may be appropriate. Remaining wastes are then managed to minimize potential present and future environmental impacts. LaRC developed a P2 Plan in 1992 to document P2 initiatives and has been implementing a Center-wide P2 Program since that date.

Over the last few years LaRC's P2 Program has been integrated into the broader Environmental Management System program that:

- 1. incorporates people, procedures, and work practices in a formal structure to ensure that the important environmental impacts of the organization are identified and addressed,
- 2. promotes continual improvement including periodically evaluating environmental performance,
- 3. involves all members of the organization as appropriate, and
- 4. actively involves Senior Management in support of the environmental management program.

LaRC's EMS is committed to the goals of Executive Order 13423, "Strengthening Federal Environmental, Energy and Transportation Management," which calls for Federal facilities to conduct their environmental activities in a continuously improving, efficient, and sustainable manner. Executive Order 13423 also dictates Agency goals regarding:

- Vehicles
- Petroleum conservation
- Alternative fuel use
- Energy efficiency
- Greenhouse gases
- Renewable power
- Building performance
- Water conservation
- Procurement
- Toxic materials and chemicals
- Electronics management

Specifically relevant to the Proposed Action is the Executive Order 13423 requirement regarding building performance: construction and renovation of buildings should be completed in accordance with sustainability strategies, including resource conservation, reduction and use; siting and indoor environmental quality.

3.6 HEALTH AND SAFETY

LaRC adheres to OSHA and applicable Federal, State and local safety and health regulations. In addition to Federal regulations LaRC also implements its own health and safety regulations many of which are referenced in Langley Policy Directive 1700.1, "Safety Program." This directive sets forth the Center's Safety Policy, which is to provide employees a safe and healthful work environment that is free from hazards that can cause or result in loss of life or injury or damage to equipment and property.

The Center Director is the ranking official charged with the ultimate responsibility for the Center's Safety Program. Implementation of the program is achieved through specific delegation of responsibilities. The LaRC Safety Office is responsible for the day-to-day implementation of LaRC's Safety Program. Each building at the Center is assigned a Facility Safety Head (FSH) and Facility Coordinator (FC) to ensure operations are carried out in accordance with LaRC's safety requirements. The FSH and FC responsibilities include establishing emergency operation procedures, reviewing and implementing facility operational procedures, and personnel training.

LaRC has been recognized by OSHA as a leader in health and safety by awarding the Center the Star designation level of achievement in the Voluntary Protection Program (VPP). In addition to its VPP and Safety Programs, LaRC has its own fire program and maintains a fire department on site which is centrally located at Building 1248. In the event of an emergency such as fire, explosion, chemical spill or other accident, fire department personnel serve as first responders to initiate actions as necessary to minimize hazards to all personnel and limit damage to property and the environment.

As part of its Safety Program, contractors performing work at LaRC must comply with all applicable safety and health regulations, including OSHA, Agency and Center regulations. Contractors are responsible for providing their own employees with a safe and healthful workplace, and for ensuring their work is performed in a safe manner. Every major on-site contractor must have a designated Safety Officer and site-specific safety and health plan. For off-sight contractors performing temporary work at the Center, supervisory personnel must attend a safety briefing provided by the LaRC Safety Office prior to project startup.

3.7 VISUAL RESOURCES

The aesthetic quality of an area or community is composed of visual resources. Physical features that make up the visible landscape include land, water, vegetation and man-made features, such as buildings, roadways and structures. As defined in the Center Master Plan, LaRC's buildings and structures reflect two broad architectural themes: an entirely functional architecture, such as wind tunnels; and institutional architecture, typical of various period architectural styles. Examples of institutional architecture at LaRC include Brick Box, Metal Box, Panel Type, Open Volume, and New Campus. Details of these architectural types are provided below:

Brick Box architecture:

- Two or three story red-brick, veneer buildings with window and door openings "punched" into the masonry surfaces.
- Window units usually arranged in a horizontal manner with textured divisions established by masonry patterns.
- Horizontal elements established with stone window sills and parapet copings.
- Window frames generally dark bronze in color.
- Usually flat roof surfaces.

Metal Box architecture:

- Flat roof structures.
- Aluminum panels used as exterior skins.
- Generally used in conjunction with "brick-box" or "panel-type" buildings.

Panel-Type architecture:

- Flat roof structures.
- Curtain-wall systems between masonry and walls.
- One or two stories high.
- Glass and colored panels within the metal grid.

Open Volume architecture:

- Ridged roof structures.
- Metal panels or corrugated cement asbestos panels used for exterior walls and roof.
- Variable exterior colors: aluminum, blue, yellow, gray.

New Campus architecture:

- Buff-brick exterior walls.
- Bronze color window frames.
- Exposed concrete structural systems.
- Pre-cast concrete facing material.
- Articulated structural elements.
- One to two-story office wings. Two to four-story support/test areas.

Fluid Structures architecture:

- Spherical and cylindrical building forms.
- Exposed structural elements.
- Silver or white color.
- Large scale elements which become dominant focal points throughout the Center.
- Functional elements clearly articulated.

The architectural styles of the buildings that would be affected by the Proposed Action are outlined in Table 3-2 below:

Building Number	Building Name	Architectural Type
1192E	Office Complex	Brick Box
1149	Inspector General/Medical Center	Brick Box
1151	Office Facility	Brick Box
1152	Office Facility/Publications	Brick Box

Table 3-2. Architectural Style of Buildings Associated with Proposed Action

Building Number	Building Name	Architectural Type
1153	Training Classrooms	Brick Box
1192	Office Complex	Brick Box
1192C	Office Complex	Open Volume
1192D	Office Complex	Brick Box
1195	Office Complex	Brick Box
1195A	Office Complex	Panel Structure
1195B	Office Complex	Panel Structure
1195C	Office Complex	Brick Box
1200	Research Complex	Metal Box
1200A	Research Complex	Metal Box
1202	Research Lab	New Campus
1202A	Pearl Young Conference Center	New Campus
1209	Office Facility	New Campus
1213	Cafeteria/Exchange Shop	Brick Box
1219	Langley Research Center Headquarters	Brick Box
1222	H.J.E. Reid Conference Center	Brick Box
1229	Office Facility	Brick Box
1230	Instrumentation Research	Brick Box
1238	1238 Complex	Brick Box
1238A	1238 Complex	Brick Box

3.8 AIR QUALITY

The Virginia DEQ administers the state's air Operating Permit Program. LaRC has a State Operating permit that establishes emission limits for specific stationary air pollution sources as well as Center-wide emission limits. The Center is not required to have a Title V Federal Operating Permit. LaRC qualifies as a synthetic minor source because its air emissions are limited below the prescribed thresholds by its air permit. The Center's air permit contains enforceable conditions that limit the amount of air pollutants that LaRC may emit. Specific permit requirements vary according to the air pollution source, but they generally include physical, operational, record keeping and reporting requirements.

The Clean Air Act (42 U.S.C. 7401 *et. seq.*), as amended, establishes the authority to set safe concentration levels for six criteria pollutants: particulate matter measuring less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), and lead (Pb). LaRC is located within the Hampton Roads Intrastate Air Quality Control Region (AQCR). The Hampton Roads AQCR includes four counties (Isle of Wight, James City, Southampton, and York) as well as ten cities (Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg). Air quality in the Hampton Roads AQCR is currently designated as attainment for all criteria pollutants. However, the Hampton Roads AQCR is considered an 8-hour ozone maintenance area.

The General Conformity Rule of the Clean Air Act (Section 176(c)) prohibits Federal actions in nonattainment or maintenance areas which do not conform to the State implementation plan

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(SIP) for the national ambient air quality standards. An action is subject to the general conformity rule if the emissions from a proposed Federal action in a nonattainment or maintenance area exceed certain annual emission thresholds (*de minimis* levels) or are regionally significant (i.e. greater than or equal to 10% of the emissions inventory for the region). In the Hampton Roads AQCR, the applicable de minimis thresholds are 100 tons per year of NO_x and 100 tons per year of VOCs. Regionally significant (10%) emissions inventories in the Hampton Roads AQCR would be 715.2 tons per year of NO_x and 879 tons per year of VOCs.

3.9 WATER RESOURCES

3.9.1 Surface Waters

LaRC is located on the coastal basin of the Back River, which flows into the Chesapeake Bay. Approximately forty percent of the LaRC drains into the Brick Kiln Creek, which runs along the northern boundary of LaRC and joins the Back River Northwest Branch. Tabbs Creek, which drains most of the rest of the Center, also flows north into the Back River Northwest Branch. A small portion of the Center in the south drains to Tides Mill Creek, which joins the Back River Southwest Branch. An upstream segment of Brick Kiln Creek, all of Tabbs Creek, and the Back River are listed as impaired waters by the EPA. All local waterways are influenced by tides in the Chesapeake Bay.

LaRC operates under three water discharge permits. A permit from the Hampton Roads Sanitation District (HRSD) allows LaRC to discharge non-hazardous industrial wastewater and sanitary sewage to the HRSD sanitary sewer system. The Center has two water permits under the Virginia Pollutant Discharge Elimination System (VPDES), which regulates industrial process wastewater and storm water discharges from the Center. LaRC has ten permitted outfalls and the VPDES permits require periodic sampling and monitoring of the effluent from the outfalls to ensure compliance with permit limits. Figure 3-4 shows the locations of LaRC's permitted outfalls in relation to the New Town activities. The outfalls that drain the areas affected by the Proposed Action are Outfalls 3, 5, 8, 9, and 12.

LaRC has few water pollution sources due to the relatively low level of industrial operations at the Center. The major pollutants are the chemicals used to treat the boilers and cooling towers, and these are discharged in accordance with LaRC's permits. LaRC employs various Best Management Practices to prevent or mitigate storm water and/or sewer system pollution from facility activities.

In accordance with Virginia's Department of Conservation and Recreation (DCR), construction activities at LaRC that disturb equal to or greater than 0.4 hectares (one acre) require coverage under the General Permit for Discharges of Stormwater From Construction Activities. Additionally, since LaRC is within a Chesapeake Bay Preservation locality, construction activities larger than 232 square meters (2,500 square feet) also require coverage.


Figure 3-4 – LaRC Outfalls

3.9.2 Wetlands

The US Army Corps of Engineers and the EPA define wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Executive Order 11990, *Protection of Wetlands*, requires Federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. NASA has a 2005 delineation of wetlands that has been confirmed by the Army Corps of Engineers. Figure 3-5 shows the scrub shrub, emergent and forested wetlands identified at LaRC. No wetlands occur near the proposed areas of New Town activity.

3.9.3 Floodplains

Floodplains are the flood-prone, lowland areas adjoining inland and coastal water including areas of offshore islands. The 100-year floodplain area is considered the area where there is a one percent chance of flooding in any given year. Due to its proximity to the Chesapeake Bay and Back River, approximately one-third of LaRC is within the 100-year floodplain. The stillwater elevation for the 100-year floodplain for LaRC is estimated by the Federal Emergency Management Agency (FEMA) to be 2.6 meters (8.5 feet) above mean sea level (MSL). FEMA has estimated 100-year floodwater levels with accompanying waves at about 3.3 meters (11 feet) above MSL near the Center. The stillwater level for the 500-year floodplain is 2.9 meters (9.8 feet) above MSL.

Executive Order 11988, *Floodplain Management*, requires each Federal agency to "take action to reduce the risk of flood loss; to minimize the impact of floods on human safety, health, and welfare; and to restore and preserve the natural beneficial values served by floodplains in carrying out its responsibilities." Federal agencies must determine whether a proposed action will occur in a floodplain, and must consider alternatives.

Figure 3-6 shows the extent of the floodplains on LaRC and the location of the proposed New Town activities. None of the proposed sites for the New Town construction, nor the buildings proposed for deconstruction or renovation, are located in the 100-year or 500-year floodplain.



Figure 3-5 – LaRC Wetlands



Figure 3-6 – LaRC Floodplains

3.10 ECOLOGICAL RESOURCES

3.10.1 Threatened and Endangered Species

The Endangered Species Act of 1973 (16 U.S.C. 1531 through 1543) was enacted to identify imperiled species and to protect the ecosystems upon which these species depend. The term, endangered species, applies to "any species that exists in such small numbers that it is in danger of extinction throughout all or a significant portion of its range." The term threatened species pertains to "any species which is likely to become an endangered species within the foreseeable future through all or a significant portion of its range." The list of endangered and threatened species, and proposed candidates for listing, are published in the Federal Register on an annual basis (50 CFR Part 17). Section 7 of the Endangered Species Act requires Federal agencies to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species.

The Virginia Endangered Species Act (Title 29.1-563) was enacted to provide protection to species of fish and wildlife threatened with extinction in Virginia. Under the Virginia Endangered Plant and Insect Species Act (Title 3.1-1020 through 3.1-1030), the Virginia Department of Agriculture and Consumer Services conserves, protects, and manages endangered and threatened plant and insect species.

No Federal or State-listed threatened or endangered species were documented at LaRC during the most recent biological survey of the Center: the 1995 "Baseline Biological Survey of Terrestrial and Aquatic Habitats at NASA Langley Research Center, With Special Emphasis on Endangered and Threatened Flora and Fauna" conducted by Old Dominion University. Although not encountered during the survey at LaRC, the species in Table 3-3 have been identified in the City of Hampton.

Common Name	Scientific Name	Status	
Turtle, Kemp's (Atlantic)	I anida ah ah a kawanii	Federal Endangered, State Endangered	
Ridley sea	Lepidochetys kempli		
Turtle, leatherback sea	Dermochelys coriacea	Federal Endangered, State Endangered	
Beetle, Northeastern	Cisin dala dana alia dana alia	Federal Threatened, State Threatened	
beach tiger	Cicinaela aorsalis aorsalis		
Turtle, loggerhead sea	Caretta caretta	Federal Threatened, State Threatened	
Plover, piping	Charadrius melodus	Federal Threatened, State Threatened	
Turtle, green sea	Chelonia mydas	Federal Threatened, State Threatened	
Rattlesnake, canebrake	Crotalus horridus	State Endangered	
Falcon, peregrine	Falco peregrinus	State Threatened	
Sandpiper, upland	Bartramia longicauda	State Threatened	
Shrike, loggerhead	Lanius ludovicianus	State Threatened	
Salamander, Mabee's	Ambystoma mabeei	State Threatened	
Shrike, migrant	Lanius ludovicianus	State Threatened	
loggerhead	migrans		

Table 3-3. Threatened and endangered species identified in Hampton, VA

Source: VA Fish and Wildlife Information Service

VA Department of Conservation and Recreation, Division of Natural Heritage

The Natural Heritage Program, which is part of the Virginia Department of Conservation and Recreation, was established to conserve Virginia's biodiversity through inventory, protection, and stewardship. The Natural Heritage Program maintains a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened, and endangered species, significant natural communities, geologic sites, and other natural features). The databases of the Natural Heritage Program were queried for occurrences of natural heritage resources in Hampton, Virginia. The databases document the local presence of threatened and endangered species (such as those in Table 3-3), as well as additional species that contribute to the local biodiversity, including the great egret (*ardea alba*), the bald eagle (*haliaeetus leucocephalus*), and the least tern (*sterna antillarum*).

3.10.2 Wildlife

LaRC supports several wildlife species with its unimproved lands providing habitat for furbearing (game) mammals, small mammals, birds, reptiles, amphibians, and fish. Tall fencing surrounding the property limits movement of many larger animals on and off the property from adjacent unimproved lands. Some species that would be expected in this area include common rodents, such as house mouse or white-footed mouse; birds such as American robin, blue jay, fish crow, and common grackle, and reptiles such as eastern box turtle. LaRC also attracts some white-tailed deer, raccoons, and Virginia opossum that forage from the adjacent woods and wetland areas. The New Town core area is located in a highly developed area that offers limited value to native wildlife.

Only Buildings 1209, 1202 and 1202A are located far enough from LaRC's busy core area that they maintain nearby wildlife resources. The forest areas west of these three buildings could support the wildlife species listed above.

3.10.3 Vegetation

Significant portions of LaRC contain undeveloped wooded vegetation (Figure 3-7) as well as large areas of maintained grass and landscaping. All the facilities that would be deconstructed or renovated as part of the New Town project are located in maintained grass areas. All construction associated with the New Town project would take place either on previously developed sites or areas of maintained grass.

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Figure 3-7 – LaRC Vegetation Resources

4.0 ENVIRONMENTAL IMPACTS

This chapter describes the potential impacts or effects of both the Proposed Action and the No-Action alternative on the environmental resources described in Chapter 3.

4.1 LAND USE

4.1.1 Proposed Action

Coastal Zone Management

Since LaRC is located within the coastal zone as defined under Virginia DEQ's Coastal Zone Management Program, proposed LaRC activities must be consistent with its enforceable policies regarding coastal resources. As noted in Section 3.1, the following enforceable policies are not applicable to the location of the Proposed Action: Fisheries Management, Subaqueous Lands Management, Dunes Management, and Shoreline Sanitation. The Coastal Lands Management policy is addressed in this section and the remaining Coastal Zone Management Program policies relating to air and water pollution are addressed in Section 4.8 and Section 4.9 respectively. As described in these sections, the Proposed Action would be consistent with the Coastal Zone Management Program's enforceable policies.

The Coastal Lands Management program regulates activities in the Chesapeake Bay Resource Management Areas (RMAs) and Resource Protection Areas (RPAs). The Proposed Action would not impact these areas because no New Town activities would take place within RPAs or RMAs.

Functional Zones

The New Town project would involve significant changes to the LaRC functional zones as displayed in Figure 4-1. Instead of the eight functional zone categories documented in Section 3.1, LaRC would recategorize the Center into the following functional zones:

- New Town
- Wind Tunnel/Laboratory
- Large Test Facilities
- Logistics and Storage
- No Build (Airfield Operations)
- Research and Development/ Engineering

The New Town project would result in environmental benefit because there would be a net increase of green space. In addition the New Town core would be a compact and pedestrian-friendly zone that would obviate the need for vehicular transportation between facilities.

4.1.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change to the current land use or functional zones.

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Figure 4-1 – Proposed Functional Zones Following Completion of New Town Project

4.2 NOISE

4.2.1 Proposed Action

With the implementation of the Proposed Action, heavy equipment and machinery would cause temporary increases in noise at the project areas and along traffic corridors. The high noise levels would be intermittent over the 15-year period. The project areas are located in highly developed areas, and high noise levels generated from aircraft and wind tunnel operations are common. Compared to noise generated by aircraft, noise produced by the construction, renovation and deconstruction activities would generally be more impulsive, relatively lower in magnitude, and spread out during the day. Table 4-1 shows examples of sound levels produced by construction equipment at a distance of 15.2 meters (50 feet). Use of heavy machinery and equipment could result in a temporary minor adverse impact on tenants of the buildings and offices near the project sites.

Equipment	Typical Noise Level (dBA) at 15.2 meters
Backhoe	80
Concrete Mixer	85
Crane Mobile	83
Dozer	85
Generator	81
Grader	85
Jack Hammer	88
Loader	85
Saw	76
Shovel	82
Truck	88

Table 4-1. Examples of Noise Levels Generated by Construction Equipment

Source: http://www.fhwa.dot.gov/environment/noise/handbook/09.htm

4.2.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change in noise levels in the area.

4.3 CULTURAL RESOURCES

4.3.1 Architectural Resources

4.3.1.1 Proposed Action

Implementation of the Proposed Action would have an adverse effect on NASA's historic resources; however, LaRC would minimize the impact by completing mitigation measures included in a Programmatic Agreement being developed among NASA, the Virginia SHPO, and the Advisory Council on Historic Preservation.

As described in Section 1.5, in accordance with NHPA Section 106 requirements, LaRC began consultation with the Virginia SHPO in 2004 regarding the Proposed Action. To clarify the potential impact of the project on the as-built environment at the Center, the SHPO recommended that LaRC perform a survey of facilities not previously surveyed or evaluated for

National Register eligibility. The architectural survey was completed in December 2007 and the results are summarized in <u>Appendix C</u>. The results of the survey provided baseline information for LaRC to begin development of a Programmatic Agreement with the SHPO and the Advisory Council on Historic Preservation for avoiding or mitigating impacts to historical resources when pursuing projects such as New Town. The Draft Programmatic Agreement is included in <u>Appendix B</u>.

LaRC will continue consultation with the SHPO and the Advisory Council on Historic Preservation regarding the development of the Programmatic Agreement, which will address implementation of the Center's Master Plan to include the New Town project and other routine actions. The agreement will outline necessary consultation procedures, documentation, and mitigation measures that LaRC would complete prior to the initiation of undertakings that could affect LaRC properties. The Programmatic Agreement will include requirements for LaRC to perform mitigation measures prior to the deconstruction or alteration of specified LaRC facilities. Examples of the potential mitigation measures includes the following:

- Recordation LaRC may prepare intensive level documentation of properties as described by the Virginia Department of Historic Resources survey guidelines and data sharing system requirements.
- Artifact Salvage and Curation LaRC may consult with parties that have expressed interest in preserving architectural elements of the buildings to determine if there are any such elements, or artifacts within the buildings, that may be salvaged for curation or display purposes.
- Public Interpretation LaRC, in consultation with the SHPO, could develop and implement a plan to allow for public interpretation of the history of the buildings. The plan may include the following elements:
 - Photographs and written records
 - Videotape interviews of persons who worked in the facilities and associated research programs
 - Development of a web-based presentation on the facilities incorporating photographs, video clips and written materials for display through the NASA website

4.3.1.2 No-Action

Under the No-Action alternative LaRC would not initiate the New Town project, and there would be no change to LaRC's architectural resources.

4.3.2 Archaeological Resources

4.3.2.1 Proposed Action

The New Town activities are located in highly industrialized areas that have experienced previous ground disturbance and the discovery of undisturbed archaeological resources would not be anticipated. In the event that resources were uncovered during construction, all earthmoving activity would immediately stop in the vicinity of the discovery and LaRC would notify the SHPO. In addition, LaRC would implement the procedures included in the CRMP for unanticipated discovery of cultural materials. As such, implementation of the Proposed Action would not affect archaeological resources.

4.3.2.2 No-Action

Under the No-Action alternative LaRC would not initiate the New Town project, and there would be no impact to archaeological resources.

4.3.3 Traditional Resources

4.3.3.1 Proposed Action

There are no traditional resources located at LaRC so the Proposed Action would have no impact on traditional resources.

4.3.3.2 No-Action

There are no traditional resources located at LaRC so the No-Action alternative would have no impact on traditional resources.

4.4 HAZARDOUS, REGULATED AND SOLID WASTE

4.4.1 Proposed Action

All hazardous and regulated waste generated from the construction and deconstruction activities would be disposed of in accordance with LaRC's waste management procedures and applicable Federal, State, and local regulations. In accordance with LaRC's building closure and demolition policies, buildings to be deconstructed would be thoroughly inspected for hazardous and regulated materials prior to deconstruction. Examples of hazardous and regulated materials that could be encountered include mercury switches, fluorescent light bulbs, oils, chemicals, and lead-based paints.

Prior to deconstruction of Building 1213, remaining fuel oil in the 200-gallon aboveground storage tank would be disposed or transferred to another facility for reuse if possible. The used cooking oil/grease in the aboveground storage tanks at Buildings 1213 and 1222 would be recycled. Many of the older facilities at the Center still have small PCB light ballasts or capacitors. LaRC ensures that PCB materials are properly packaged, transported and disposed of at an approved disposal facility. Asbestos is also present in many LaRC buildings. Asbestos containing materials have been identified in the following buildings affected by the Proposed Action: Buildings 1149, 1151, 1152, 1192, 1192C, 1192D, 1195A, 1200, 1202, 1209, 1213, 1219, 1222, 1229, 1230, 1238, and 1238A. All contractors performing asbestos work at LaRC would be appropriately licensed, and the waste would be properly packaged, labeled and transported to a permitted landfill. To reduce the potential for asbestos to be released into the air, standard asbestos emission control procedures would be followed in accordance with the EPA Asbestos Regulations (40 CFR 61 Subpart M) and LaRC's procedural requirements for handling asbestos. All friable asbestos containing materials would be removed from a facility before any activity begins that would break up or disturb the material.

In the event that petroleum contaminated soils and ground water were discovered during the construction, renovation, and deconstruction activities, LaRC would properly characterize and dispose of such materials at an appropriately permitted waste management facility.

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Implementation of the Proposed Action would generate a large volume of solid waste including concrete, structural steel, and miscellaneous building components. As described in 4.5.1, contractors would be directed to recycle materials to the maximum extent possible, thereby reducing the amount of construction/deconstruction debris disposed in landfills. Non-hazardous, non-regulated, solid materials that are not collected for recycling are consolidated and transported for disposal to a local landfill or for energy recovery at Hampton's Refuse-Fired Steam Generating Facility. As such, implementation of the Proposed Action would have a negligible impact on the environment resulting from the generation of hazardous, regulated and solid waste.

4.4.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change to the current levels of hazardous, regulated or solid waste generation at the Center.

4.5 POLLUTION PREVENTION

4.5.1 Proposed Action

The New Town project would be carried out following LaRC's principles of P2, to include source reduction, recycling/reuse, treatment and proper disposal of wastes. Materials generated from the renovation and deconstruction projects such as concrete, steel structural elements and other metals would be recycled to the maximum extent possible. Furthermore, contractors would be required to follow applicable Best Management Practices to further reduce pollution. While there would be a temporary increase in solid waste generated from New Town activities, this would be offset by replacing outdated, inefficient facilities with energy-efficient, sustainably designed structures.

The newly constructed/renovated New Town buildings would conform to the "silver" or possibly the "gold" standard established by the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. This system promotes sustainable green designs using specific performance criteria in five key areas: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED provides a third party certification for the design, construction and operation of high performance green buildings. Sustainability initiatives that LaRC could potentially implement for New Town buildings include energy-efficient lighting; "green" roofs; xeriscaping; and the use of wind, solar, or geothermal energy. LaRC's LEED certification would confirm LaRC's contribution to NASA's agency goals for high performance and sustainable buildings outlined in Executive Order 13423, Section 2(f). The implementation of the Proposed Action would be a net long-term benefit to the pollution prevention and EMS goals of the Center and the Agency.

4.5.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change in the levels of wastes or pollution generated at the Center.

4.6 HEALTH AND SAFETY

4.6.1 **Proposed Action**

The construction, renovation and deconstruction activities performed during the New Town project would be carried out by qualified and properly licensed and permitted contractors. Contractors performing work at LaRC are required to comply with all applicable safety and health regulations, including OSHA and NASA regulations. Contractors involved in the project would be required to prepare and follow a site-specific Health and Safety Plan that complies with the regulations to ensure the safety of human health and the environment during the New Town activities. Adherence to applicable health and safety procedures would minimize the risk of injury to either the contractors working in the active project areas or the surrounding LaRC personnel. Therefore, the Proposed Action would not result in significant health or safety impacts.

4.6.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and LaRC personnel would continue to occupy aging facilities. Over time there could be a slight increase in the potential for health and safety problems due to the aging infrastructure.

4.7 VISUAL RESOURCES

4.7.1 Proposed Action

Implementation of the Proposed Action would involve upgrading and improving the overall campus-like center of the Center. The New Town core would be characterized by modern facilities in a cohesive and consistent architectural style. New Town buildings would establish a new image for LaRC, while respecting remaining buildings and landscape. In order to ensure that New Town would be consistent with already established campus scale, new buildings would vary from two to five stories. The existing pedestrian spine would be reinforced and expanded. An uninterrupted sequence of large open spaces would be created along the pedestrian spine, filled predominantly with lawn trees (mostly existing) and some paving. New trees would screen parking lots from the pedestrian spine, while reinforcing visibility between adjacent spaces as well as visibility of landmark structures such as vacuum spheres and wind tunnels. Although visual resources in the immediate project areas would be temporarily degraded during the active construction, renovation and deconstruction activities, the resulting New Town setting would provide enhanced visual quality.

In addition, the deconstruction of facilities outside the core would remove deteriorated and aging infrastructure from LaRC's landscape and create new open spaces. The resulting open space would improve LaRC's visual resources as the areas would be graded and seeded following deconstruction. Therefore, implementation of the Proposed Action would have a long-term positive impact on visual resources at LaRC.

4.7.2 No-Action

With the No-Action alternative, without maintenance, the exterior of many of the older, abandoned facilities would continue to deteriorate. The facilities would become "eye sores" that detract from the aesthetic quality of the Center. Continued degradation would result in a further

decline in aesthetic value. As such, implementation of the No-Action alternative would result in a negative impact to the visual resources at LaRC.

4.8 AIR QUALITY

4.8.1 Proposed Action

The construction, renovation and deconstruction activities would result in a slight increase in emissions from vehicle/equipment exhaust and from fugitive dust. These effects would be minor and staggered over the length of the project. In relation to the large number of personal and Government vehicles operating on the Center, the additional emissions resulting from vehicles and from equipment would be negligible. In addition, fugitive dust would be minimized by using control methods outlined in the Virginia Regulations for the Control and Abatement of Air Pollution (9 Virginia Administrative Code 5-50-90). These precautions may include the use of water for dust control, covering of open equipment for conveying materials, prompt removal of spilled or tracked dirt from paved streets, and removal of dried sediments resulting from soil erosion.

The Proposed Action is not subject to the General Conformity Rule of the Clean Air Act because emissions of applicable pollutants would not exceed annual de minimis thresholds, nor are they regionally significant (i.e. 10% of regional emissions inventory). Since the Hampton Roads AQCR is an ozone maintenance area, the emissions of ozone precursor pollutants (VOCs and NO_x) were calculated for the New Town project. LaRC's calculations of the estimated emissions for the New Town project compared to de minimis and regional emissions inventories are displayed in Table 4-2.

Pollutant	Maximum Emissions from Proposed Action	De Minimis Threshold	10% of Regional Emissions Inventory
NO _x	18.6 tons per year	100 tons per year	715.2 tons per year
VOCs	3.8 tons per year	100 tons per year	879 tons per year

Table 4-2. Air Conformity Applicability

Source: US Air Force Conformity Applicability Model (ACAM) 4.3.3

The Proposed Action would not involve open burning. All deconstruction materials would be removed from the Center for recycling, landfill disposal or for energy recovery at Hampton's Refuse-Fired Steam Generating Facility.

Any stationary air emission sources installed in the newly constructed New Town facilities would be added to LaRC's *Stationary Source Permit to Operate* from the Virginia DEQ. LaRC would ensure that new equipment or systems that result in air emissions would comply with the Federal Clean Air Act as enforced by the Virginia State Implementation Plan and the State Air Control Board (Code of Virginia § 10-1.1300). Therefore the Proposed Action would be consistent with the enforceable air management policies of the Coastal Zone Management Act. As such, implementation of the Proposed Action would result in minimal impact on air quality at LaRC.

4.8.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change in LaRC's impact on air quality.

4.9 WATER RESOURCES

4.9.1 Surface Waters

4.9.1.1 Proposed Action

The Proposed Action would result in minimal impact to the surface water resources of LaRC and the surrounding environment. Soil disturbance during construction, renovation and deconstruction activities would produce a minor and temporary increase in suspended solids in the stormwater reaching the outfalls that drain the affected areas (primarily Outfalls 3, 5, 8, 9, and 12). In accordance with Virginia's Department of Conservation and Recreation (DCR), construction activities at LaRC that disturb equal to or greater than 0.4 hectares (one acre) require coverage under the General Permit for Discharges of Stormwater From Construction Additionally, since LaRC is within a Chesapeake Bay Preservation locality, Activities. construction activities larger than 232 square meters (2,500 square feet) also require coverage. Silt fences, storm drain inlet and outlet protection, and other appropriate standard construction practices would be implemented in accordance with the erosion and sediment control requirements of Virginia's DCR. Additionally, LaRC would ensure that the contractors obtain the appropriate permits and prepare the required plans in accordance with DCR's construction site stormwater permit requirements. Following completion of the New Town project, there would be no long-term impact to the quality or quantity of stormwater drainage to the outfalls.

The Virginia Coastal Zone Management Program maintains enforceable policies related to point source and non-point source water pollution. The Proposed Action does not involve point source water pollution, but does have the potential to generate a non-point water pollution source. The Coastal Zone Management Program requires that soil-disturbing projects be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the State's waters. The contractors would adhere to the standards of LaRC's current VPDES permit (General Permit for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems) that requires LaRC to implement Best Management Practices (BMPs) mitigating stormwater pollution from Center activities. These BMPs include employee training, preventive maintenance, visual inspections, spill prevention and response, sediment and erosion control, good housekeeping, and record keeping and reporting. Since LaRC would implement appropriate BMPs to reduce erosion and pollution, the Proposed Action would be consistent with the Coastal Zone Management Program.

New systems or equipment that consume water and/or generate wastewater would be evaluated prior to their installation in the New Town facilities. LaRC would ensure that all new water discharge sources would be compliant with applicable regulations and LaRC permits. In addition LaRC personnel would review water usage and discharge operations to identify opportunities for conserving water and minimizing wastewater pollutants. As such, implementation of the Proposed Action would result in minor impacts to water resources at LaRC.

4.9.1.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change in LaRC's impact on surface water resources.

4.9.2 Wetlands.

4.9.2.1 Proposed Action

The Proposed Action would have no impact on LaRC's wetlands. No project activities associated with the New Town initiative would take place near identified wetlands.

4.9.2.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no impact on wetlands.

4.9.3 Floodplains

4.9.3.1 Proposed Action

Neither the proposed site of the New Town construction, nor the buildings proposed for deconstruction or renovation, are located within the 100-year or 500-year floodplain, as documented in Figure 3-6. Therefore Executive Order 11988, *Floodplain Management*, is not applicable to the New Town project, and the Proposed Action would have no impact on LaRC's floodplains.

4.9.3.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be change in LaRC's use of floodplains.

4.10 ECOLOGICAL RESOURCES

4.10.1 Threatened and Endangered Species

4.10.1.1 Proposed Action

No Federal or State-listed threatened or endangered species would be adversely affected by the Proposed Action. No threatened or endangered species are known to inhabit LaRC. It is possible that some of the threatened and endangered species identified in the adjacent City of Hampton could also inhabit LaRC, although these species would not be anticipated in the New Town project area. Most of Hampton's identified threatened and endangered species are aquatic or beach-dwelling species: several sea turtles, the Northeastern beach tiger beetle, the upland sandpiper and the piping plover. The other threatened and endangered species found in Hampton, (two shrikes, the peregrine falcon, a salamander and a rattlesnake) would not be anticipated to inhabit the New Town project areas because these areas have experienced heavy development and high levels of human activity. Although the Division of Natural Heritage documents the presence of natural heritage resources in the Hampton area, it is not anticipated that the Proposed Action would adversely impact these resources because of the scope of the activity and the distance to the resources.

4.10.1.2 No-Action

Under the No-Action alternative, the New Town project would not occur and there would be no change to the current status of LaRC's threatened or endangered species.

4.10.2 Wildlife

4.10.2.1 Proposed Action

Disturbance resulting from the Proposed Action would be limited to the local project sites. The activity and noise generated from construction, renovation and deconstruction activities would temporarily displace most wildlife from the immediate vicinity of the project areas. It is expected that the impacts to wildlife caused by the New Town project activities would be very minor and short-term.

Implementation of the Proposed Action would result in long-term positive impact to wildlife as removal of the buildings would result in more open green space on LaRC property. Buildings 1209, 1202 and 1202A are located adjacent to a forested area that supports LaRC's wildlife resources, and removal of these buildings could permit the expansion of the forest habitat into these previously developed areas.

4.10.2.2 No-Action

Under the No-Action alternative, the New Town project would not occur and there would be no change to the current status of LaRC's wildlife resources.

4.10.3 Vegetation

4.10.3.1 Proposed Action

All New Town activities would take place in highly developed areas. The only vegetation that would be impacted by the Proposed Action would be landscaping plants and manicured grass in the construction areas, but these landscapes would be replanted following completion of New Town. There would be a net increase in vegetation at the Center because the removal of facilities would result in increased green space. These cleared areas would be reseeded or allowed to revert to native vegetation. Therefore the Proposed Action would have a slight positive impact on LaRC's vegetation resources.

4.10.3.2 No-Action

Under the No-Action alternative, LaRC would not initiate the New Town project, and there would be no change to LaRC's current vegetation.

5.0 CUMULATIVE EFFECTS

The CEQ regulations require that all Federal agencies include cumulative impacts in their environmental analyses (40 CFR 1508.25(c)). Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). This includes those that may be "individually minor but collectively significant actions taking place over time" (40 CFR 1508.7).

Cumulative effects are most likely to arise when a relationship exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in close proximity to the proposed action would be expected to have more potential for a relationship than actions that may be geographically separated. Similarly, actions that coincide, even partially, in time would tend to offer a higher potential for cumulative effects. The scope of the cumulative impacts analysis involves both the geographic extent of the effects and the timeframe in which the effects could be expected to occur.

The geographic extent for the environmental resources analyzed in this EA is limited to the local LaRC West Area because the region of influence for potential environmental impacts from the proposed project is largely confined within the LaRC fence line. The timeframe includes recent past and present actions continuing into the foreseeable future at LaRC. An effort has been made to generally identify actions that are being considered and that are in the planning phase at this time.

5.1 PAST, PRESENT AND REASONABLY FORESEEABLE ACTIONS

As an active research facility, LaRC undergoes continual change in order to align its capabilities with the Agency's overall mission. Like any major research installation, LaRC requires new construction, facility improvements and infrastructure upgrades to ensure the Center's resources are appropriate for carrying out its research. Many of LaRC's recent past, present and foreseeable future actions are related to an overarching NASA objective to streamline the Center's infrastructure and restructure and modernize the Center's facilities. To meet NASA's evolving mission requirements, LaRC continues to pursue projects that transform the Center into a more modern, efficient, and technologically advanced Center. Given the age of LaRC's infrastructure and the changes in NASA's mission, many facilities have outlived their useful life and require extensive renovation or deconstruction.

Between 2004 and 2006, LaRC demolished fourteen dilapidated and abandoned buildings in order to reduce the Center's unneeded and unused infrastructure. Architectural surveys were performed on the facilities and the surveys determined that none of the buildings were culturally or historically significant. Based on the EA prepared for the project, LaRC determined that minimal environmental impacts would result from the demolitions, and a Finding of No Significant Impact (FONSI) was issued.

In early 2008, LaRC began deconstructing Building 1212B, the 7x10-Foot High Speed Tunnel. NASA closed the facility in 1994 due to lack of need and because duplicate or superior testing

capabilities exist at other NASA facilities. Since Building 1212B was determined eligible for listing in the National Register, LaRC developed a Memorandum of Agreement with the SHPO to minimize the adverse effect of deconstruction. In accordance with Section 106 of the National Historic Preservation Act and the mitigation stipulations of the Memorandum of Agreement, LaRC prepared Level 1 Historic American Engineering Record documentation on the facility, and developed a public interpretation website. After Section 106 consultation was complete, LaRC prepared an EA that determined no substantial environmental impacts would occur as a result of the deconstruction, and a FONSI was issued.

LaRC is planning to deconstruct four closed wind tunnels between 2009 and 2012. The facilities are Building 640 (the 8-Foot Transonic Pressure Tunnel), Building 641 (the 8-Foot High Speed Tunnel), Building 643 (the Full Scale Tunnel), and Building 1146 (the 16-Foot Transonic Tunnel). The decision to deconstruct the facilities is based on the determination of no current or future government need to use the tunnels and no viable plans from non-governmental entities (industry, universities, etc.) to operate or adaptively reuse the facilities. The deconstructions would reduce NASA's infrastructure and allow LaRC to direct limited resources toward facilities that support NASA's overall mission. The Proposed Action would result in an adverse effect to LaRC's cultural resources since two of the facilities are National Historic Landmarks (NHLs) and two are eligible for listing in the National Register, both individually and as contributing resources to a proposed historic district. In order to mitigate the loss of the NHLs, NASA fulfilled the consultation and mitigation requirements of the Programmatic Agreement among NASA, the National Conference of SHPOs, and the Advisory Council on Historic Preservation, for management of NASA's NHLs. LaRC prepared Historic American Engineering Record documentation; consulted with the Smithsonian Institution regarding salvage of significant artifacts; and developed a website to preserve photographs, film clips, interviews with researchers, and virtual reality tours of the properties. For the two National Register eligible properties, NASA is in the process of developing a Memorandum of Agreement with the SHPO that will contain mitigation measures similar to those in the NHL Programmatic Agreement. An EA for deconstruction of the four wind tunnels was developed, and LaRC determined that no substantial environmental impacts would occur as a result of the Proposed Action. A FONSI was issued in June of 2008.

LaRC is proposing to deconstruct thirteen abandoned or under-utilized buildings throughout the Center during the 2008-09 timeframe. The purpose of the proposed deconstruction is to streamline LaRC's infrastructure by removing deteriorating facilities that are no longer operational and/or needed to support NASA's mission. Four of the buildings are potentially eligible for listing in the National Register as contributing resources to LaRC's proposed historic district. LaRC is performing consultation with the SHPO under Section 106 of the National Historic Preservation Act regarding deconstruction of these four buildings to include mitigation measures to minimize the adverse effects of the project.

As described in Section 1.3 the Agency's evolving mission, especially the Constellation Program to return humans to the moon, could affect the activities and operations at the NASA field Centers. LaRC's contribution to the Constellation project including leading the Launch Abort System integration project requires the introduction of various new research and development activities at the Center. NASA performed an agency-wide Programmatic Environmental Impact

Statement to document the effects of the project at each NASA field Center. The current and reasonably foreseeable activities that would occur at LaRC in support of Constellation would be similar to ongoing research activities conducted at LaRC in support of existing programs.

5.2 ANALYSIS OF CUMULATIVE IMPACTS

The following analysis examines the impacts on the environment that could result from the incremental impact of the Proposed Action when added to the actions described above. The analysis examines whether such a relationship would result in potentially significant impacts not identified when the Proposed Action is considered alone.

With the exception of cultural resources, LaRC has determined that the projected effect of the Proposed Action, coupled with the other past, current and future actions described above, would result in minimal cumulative impacts to the resources analyzed in this EA.

LaRC has determined that the projected cumulative effect of the Proposed Action, coupled with the other past, current and future actions occurring at LaRC would be the potential loss or alteration of LaRC's historic properties. The impacts would be caused by the removal or modification of historic properties and the potential change in the character or integrity of LaRC's proposed historic district. In accordance with Section 106 of the National Historic Preservation Act, LaRC would minimize and mitigate the impacts to historic properties in consultation with the SHPO and other interested parties. LaRC would carry out appropriate mitigation measures to preserve LaRC's history and legacy to the maximum extent practical. LaRC is developing a Center-wide Programmatic Agreement with the Virginia SHPO and the requirements of the Programmatic Agreement, LaRC will take into consideration the effect that LaRC's actions may have on individual properties as well as the overall integrity of LaRC's proposed historic district. While the resources once removed would be lost, the history of the facilities would be preserved through mitigation measures, as described in Section 4.3.1.1.

6.0 REFERENCES

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Virginia Department of Game and Inland Fisheries, 2008. Fish and Wildlife Information Service. <u>http://www.vafwis.org/fwis/</u>

7.0 LARC PREPARERS AND CONTRIBUTORS

The LaRC Environmental and Logistics Branch prepared this EA. Individuals listed below contributed to the completion of the document by writing portions of the text, contributing background and supporting information, or providing technical review/comment on the draft.

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Mr. Charles W. Burgess, Jr., City Manager, Poquoson, Virginia.

Mr. Arthur L. Collins, Executive Director, Hampton Roads Planning District Commission, Chesapeake, Virginia.

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APPENDIX A

CONSULTATION LETTERS AND CORRESPONDENCE

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COMMONWEALTH of VIRGINIA

Department of Historic Resources

W. Tayloe Murphy, Jr. Secretary of Natural Resources 2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick Director

> Tel: (804) 367-2323 Fax: (804) 367-2391 TDD: (804) 367-2386 www.dhr.state.va.us

22 October 2004

Rodney T. Harris, Master Planner Capital Investment Planning Office Mail Stop 446 Langley Research Center Hampton, Virginia 23681-2199

Re: NASA Langley Research Center

Demolition initiative and New Town project - DHR File Number 2002-1560 Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 Programmatic agreement for routine activities Hampton, VA

Dear Mr. Harris.

Thank you for meeting with staff from the Virginia Department of Historic Resources (DHR) in August to discuss NASA's proposal to remove several facilities from the NASA Langley Research Center (LaRC), including the following:

Building 640 - 8-ft. Transonic Tunnel Building 641 - 8-ft. High Speed Tunnel (tunnel only) - DHR no. 114-0139 Building 1146 - 16-ft. Transonic Tunnel (tunnel only) and associated buildings 1146A-C and 1146G-M Building 1212B - Gantry (Lunar Landing Research Facility) - DHR no. 114-0140, and associated buildings 1297A-G

Building 643 - 30 X 60 ft. Full Scale Tunnel - DHR no. 114-0142

Your letter of 22 July outlining this initiative notes that buildings 641, 1212B, and 643 are National Historic Landmarks, and that buildings 640, 641, and 643 are within LaRC's East Side, on Langley Air Force Base (LAFB) property, and within the proposed Langley Air Field Historic District. Further, your letter notes that buildings 640 and 1146 may be potentially eligible for listing as National Historic Landmarks, and that building 1212B is over 50 years of age.

During the meeting, preliminary information was also provided on the New Town project, and the project area was investigated. Also, you expressed interest in conducting an installation wide survey of cultural resources, and exploring the possibility of setting up a programmatic agreement for management of the cultural resources at LaRC. Since the meeting, NASA provided DHR with a copy of the NASA Langley Research Center Draft Cultural Resource Management Plan (CRMP).

iministrative Services .0 Courthouse Avenue Petersburg, VA 23803 Tel: (804) 863-1624 Fax: (804) 862-6196

Capital Region Office 2801 Kensington Ave. Richmond, VA 23221 Tel: (804) 367-2323 Fax: (804) 367-2391

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NASA Langley Research Center Demolition initiative and New Town project Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 Programmatic agreement for coutine activities Hampton, VA

DHR would like to offer comments concerning the proposed demolition initiative, the New Town development, on the CRMP, and the development of a programmatic agreement.

Demolition initiative and New Town project:

From discussions at the August meeting with you and other NASA staff and consultants, DHR understands that alternatives to demolition are being explored by NASA for two of the wind tunnels, as is required by the Section 106 regulations set forth in the National Historic Preservation Act of 1966, as amended. One of the alternatives is continued use, currently in place with Old Dominion University and NASCAR; the cost of rehabilitation and repair for another tunnel is being considered. Also, according to the Programmatic Agreement Among the National Aeronautics and Space Administration, the National Conference of State Historic Preservation Officers, and the Advisory Council on Historic Preservation, executed in 1989, which addresses the National Historic Landmark facilities, "NASA will apply its agreement with the Smithsonian Institution (NASA Management Instruction 4310.4) to determine appropriate retention and curation activities with respect to significant artifacts." DHR understands from discussions during the meeting that NASA is exploring opportunities for transfer of some of the resources, or their components. DHR looks forward to ongoing consultation with NASA concerning this initiative as plans develop. As NASA moves forward with this initiative, please make sure that the Advisory Council on Historic Preservation (ACHP) has been notified by formal letter of the initiative, and has been invited to participate in consultation. It is also advisable to contact the U.S. Department of the Interior, due to the potential for an adverse effect on NHL resources at LaRC. Also, DHR will plan to continue consultation with NASA concerning the New Town project as it moves forward.

Programmatic agreement:

To clarify the potential impact of the New Town project, DHR recommends that NASA consider carrying out an installation wide survey and assessment of properties that have not yet been documented and evaluated, but may meet the National Register Criteria. This would also provide base level information for the development of a programmatic agreement (PA). As discussed at the August meeting, at a minimum, a programmatic agreement can address routine actions that can be exempt from Section 106 review, as they would not result in an adverse effect on historic properties. In addition, with knowledge of resources at LaRC, a PA can cover a broader range of treatments, and allow NASA to take more responsibility for cultural resources management. This can result in fewer routine consultations with DHR, streamlining the consultation process for both DHR and NASA. As an example, the Navy Command, Naval Region Mid-Atlantic PA was discussed at the meeting and an electronic version was sent to you for consideration. If you have questions about this agreement, DHR would be happy to address them.

A PA to cover routine actions would include a list of treatments that can be exempt from review. The CRMP has a list of no effect activities, which DHR considered as the basis for a list of exempt activities. Concerning archaeological resources, DHR offers the following comments on the list:

Items 1-4 - These activities must avoid additional ground disturbance as well. This also applies to items 20 (replacement of sidewalks), 23 (replacement of foundations, etc) and 24 (construction of roads). Additional ground disturbance should require consultation with the FPO.

NASA Langley Research Center Demolition initiative and New Town project Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 Programmatic agreement for routine activities Hampton, VA

Item 5 - (replacement of trees, etc) - This is acceptable in areas of low/no probability for archaeological deposits. In moderate/high probability areas leaving the root balls in place is recommended, as is testing in any areas where new plantings will be placed. This activity should be coordinated with the FPO.

Item 25 (staging areas) - This is acceptable in low/no probability areas. In moderate/high probability areas, or in areas of known archaeological significance, this activity should be avoided if possible (staging of heavy equipment can compact soils and damage subsurface deposits). If avoidance is not possible, consultation with the FPO is recommended.

For architectural and landscape resources, the list of no effect activities is suitable for a list of exempt activities, and can be expanded to consider other treatments, in consultation with DHR.

DHR looks forward to consulting further with you regarding the development of a PA. Please contact the ACHP by formal letter regarding NASA's intention to develop a PA, and invite the ACHP to participate in consultation. It is also advisable to contact the U.S. Department of the Interior, due to the presence of NHL resources at LaRC.

CRMP:

The CRMP was prepared for NASA by Gray and Pape, Inc., Richmond, Virginia. The CRMP's Executive Summary states that the goals of the CRMP are to "provide guidelines and information that will facilitate the historic preservation process at the LaRC [Langley Research Center]." The CRMP was prepared in response to obligations of federal agencies to their cultural resources, established by Section 106 and Section 110 of the National Historic Preservation Act of 1966, as amended (NHPA).

The draft CRMP is a thorough document that meets the intended objectives. DHR staff has reviewed the document, and offers the following suggested revisions to make application of the guidance in the document more effective:

- Executive Summary Page 1 and following: abbreviation for Langley Research Center initially given as LaRC, then on page 2 and following, as LRC. One abbreviation should be used consistently.
- Executive Summary Page 3: a comprehensive survey of resources has not been completed; this should be done to identify historic properties for appropriate treatment according to the guidance provided by the CRMP, as noted on page 49 of the CRMP.
- Executive Summary Page 4: reference to the Secretary of the Interior's guidelines and standards should include correct name.
- Index provided with the user's guide is a useful tool.
- Page 3, 3rd paragraph: "Follow" should be "following".
- Page 3, bullet points: Clarify "undertaking" using language from regulations, rather than "will it effect cultural resources".
- · Page 3, 4th paragraph: Clarify function of Section 106 more precisely.
- Page 4, 4th paragraph: Was CRMP integrated into the LaRC Master Facilities Plan?
- Page 6 and following: The association between the Air Force Base and the Research Center is not explained. As part of LaRC overview, relate history to that of Langley Air Force base, and make clear the physical interconnection of the two installations.

NASA Langley Research Center Demolition initiative and New Town project Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 Programmatic agreement for routine activities

- Hampton, VA
 - Page 8, 1st and 2nd paragraphs: Table 1 and Table 3 are embedded in the text rather than Appendix D as noted. Again, a comprehensive survey of resources has not been done; this information is needed for effective application of the guidance in the CRMP.
 - Page 8, 4th paragraph: Clarify the information provided here, as only seven cultural resources identified on LaRC property were evaluated for National Register eligibility. Also, we remind you that consultation with the SHPO is necessary for all undertakings, not just those that may affect National Register listed or National Historic Landmark properties, unless categorically excluded under agreement with this office.
 - Page 15: Tables 2 and 3 are embedded in the text rather than in Appendix D as noted.
 - Page 16, 2nd paragraph: Will LaRC consider all properties 50 years of age and over "historic properties" according to the NHPA, until evaluation of these properties can be performed? As noted above, and noted on page 49 of the CRMP, documentation and evaluation of all properties, including those less than 50 years of age, should be completed as these properties may meet National Register Criteria Consideration G for association with space program developments within the past 50 years.
 - Page 20 and following: The Section 106 regulations have been revised since this draft was completed in 1995. We recommend that you update the CRMP to reflect these revisions (including the emphasis upon public participation as well as consultation with other interested parties - including Native American tribes - during all steps of the 106 process).
 - Page 23: An adverse effect is not necessarily "harm", but is rather an alteration of the characteristics of a property that render it eligible for the National Register. 36CFR800.5(1) has language that may be cited in this instance. Also, please clarify that adverse effects may be avoided, minimized, or mitigated, not made "less harmful."
- Page 24 and following: Provide appropriate citations for National Register of Historic Places documents and regulations. Also, it would be useful to reference and include National Register Criteria Considerations, perhaps as an appendix including the full text of the Criteria for Evaluation, Criteria Considerations, and explanation of integrity.
- Page 24, 1st paragraph: Clarify the distinction between, and differences in treatment of, National Register listed properties and properties that are designated National Historic Landmarks. In line 7 the term "National Register" should be replaced by "Section 106 regulations".
- Page 24, 2nd paragraph: Clearly state that only one of the National Register Criteria . needs to be met for a property to be considered eligible; as worded it appears that all Criteria must be met.
- Page 25, 1st paragraph: Citation should be 36CFR800.4(a)(1). .
- Page 25, 2nd paragraph: 36CFR800.9 is not applicable. Note that 36 CFR Part 800.16(i) provides the definition of "effect", which can be quoted or referenced here.
- Page 28, 4th paragraph: As noted above, an adverse effect cannot be reduced.
 Page 29, 2nd paragraph: Painting need not be considered a repair action that has the potential to affect a historic property. Painting of surfaces historically painted, when preparation and painting procedures are not invasive or likely to cause any damage to historic fabric (such as by sandblasting, high power washing, etc.), may be considered an activity that does not have the potential to cause an effect.
- Pages 41-42: Modify to reflect Section 106 regulations the "transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long term preservation of the property's historic significance" is considered an adverse effect.

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NASA Langley Research Center Demolition initiative and New Town project Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 Programmatic agreement for routine activities Hampton, VA

- Pages 45-46: Removal of dead/diseased trees may result in damage to archaeological resources. Trees in known sites or unsurveyed areas should be removed at the ground surface and the root ball left in place when possible.
- Page 46, 11th bullet point: "Repair" should read "Replacement".
- Page 50: Federal curation standards apply both to artifacts and to the documents (field notes, reports, photographs, etc) that accompany them.
- Page 51-52: Inclusion of public outreach programs recognizes an important aspect of cultural resource management and NHPA compliance as well.
- Page 53: Recognition of survey of undocumented areas and resources as the first cultural resource management priority is appropriate. Text should indicate that the referenced maps are contained in Appendix A.

General comments:

- Clarify use of the terms "cultural resources", "historic resources", and "historic properties" throughout the text, according to the meaning of these terms in the NHPA Section 106 and Section 1110 regulations.
- Correct text to reflect current NHPA Section 106 regulations.
- Make reference to useful websites wherever appropriate in the text, including the site for the Advisory Council on Historic Preservation, the National Park Service sites regarding the National Register of Historic Places criteria and their application, the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes, and the Preservation Briefs and their application, and any applicable sites related to NASA programs, cultural resource operations and compliance for the DoD that may apply to NASA or NASA property at Langley Air Force Base, etc.
- Clarify the role of the "Preservation Officer" referred to in sections of the document. This individual should meet the Secretary of the Interior's Professional Qualifications Standards, which should be set forth in the CRMP. Also, if possible, the Preservation Officer should manage and direct the cultural resources management efforts outlined in the CRMP. Please use consistent name or abbreviation throughout the document to reference the Preservation Officer (in the exempt activities list the reference is to "FPO").
- Any future surveys should include analysis of cultural landscapes, and a cultural landscapes study should be done as part of the planned cultural resources identification survey.

The Advisory Council on Historic Preservation (ACHP) should be given the opportunity to review the ICRMP if they have not already done so. Please provide DHR with copies of correspondence with the ACHP concerning the CRMP.

Thank you again for requesting our comments. If you have any questions regarding these comments or if we can be of any further assistance, please contact Joanna Wilson at (804) 367-2323 ext. 140, or <u>Joanna Wilson@dhr.virginia.gov</u>, or Ethel Eaton at <u>Ethel.Eaton@dhr.virginia.gov</u>, or (804) 367-2323 ext. 112.

NASA Langley Research Center ¹ Demolition initiative and New Town project Draft Cultural Resource Management Plan (CRMP) - DHR File Number 1999-0421 ² Programmatic agreement for routine activities Hampton, VA

Sincerely,

Susan E. Smead

Architectural Historian/Historian and Preservationist III

Distribution List Letter to Potentially Concerned Agencies dated November 4, 2005

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Quality	Program Manager
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City of Hampton	Mr. Jesse Wallace
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Hampton Roads Planning District	Mr. Arthur L. Collins
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Letter to Potentially Concerned Agencies (LTPCA)

November 4, 2005

[Name] [Title] [Address]

Subject: Compliance with the National Environmental Policy Act (NEPA)

Dear [Name]:

This letter is to inform you that NASA Langley Research Center (LaRC) is in the process of preparing an Environmental Assessment (EA) for a major repair by replacement upgrade project at LaRC in Hampton, Virginia. The initiative, called "New Town" includes construction of 6 new buildings, including 3 laboratories, 2 administrative office buildings, and a shared use facility (food service & conference center); renovation of 2 additional buildings; and demolition of approximately 25 older buildings. It is estimated that the proposed project would be completed in three phases over fifteen years. Enclosed is a map showing the New Town core area and applicable information.

The New Town project is intended to modernize the center core of LaRC, while significantly reducing the Center's Operations & Maintenance costs. The project would reduce the building inventory by approximately 134,000 sq ft, creating additional green space at the Center. The main theme of the New Town project is to improve current and future Mission performance capability while ensuring quality of life. New Town would 1) provide new facilities that are highly efficient and flexibly adaptable to changing requirements; 2) enhance the Center's townscape with attractive new architecture, landscaping, and efficient traffic patterns while preserving sites of historic and cultural interest; 3) meet as many objectives as possible of Executive Orders that support sustainable design; and ensure building construction and renovation complies with at least the Leadership in Energy and Environmental Design (LEED) Green Building Rating System - Silver standards, and 4) investigate use of "enhance use leasing" of abandoned buildings and property.

We have already begun consultation with the Virginia Department of Historic Resources regarding this project to ensure proper management of LaRC's historic and cultural resources.

As we want to ensure that the EA addresses all areas of concern, we are soliciting comments from your office on the proposed New Town project. Comments are requested by December 23, 2005 and should be sent to the following address:

Page 1
NASA Langley Research Center Attn: Mr. Roger Ferguson, Environmental Management Team MS 318, Building 1238 Hampton, VA 23681-2199 e-mail: <u>r.g.ferguson@larc.nasa.gov</u>

Should you or your staff have any questions or require additional information regarding this project, please contact me at 757-864-6912.

Cordially,

Gregory F. Sullivan, P.E. Head, Environmental Management Team

Page 2

Response from Virginia Department of Historic Resources



Mr. Roger Ferguson New Town Development December 2, 2005 Page 2 eligible historic district is present at NASA/LaRC, then this will need to be taken into consideration as well. If you wish to proceed with the Section 106 process for this project before the base-wide architectural survey is completed, you may prepare information about the presence of historic properties within the APE for this project. If you have any questions about the Section 106 review process or our comments, please call me at (804) 367-2323, Ext. 140. Sincerely, 0 Joanna Wilson, Archaeologist Office of Review and Compliance Mr. Rodney Harris, Master Planner cc:

Response from Langley Air Force Base

DEPARTMENT OF THE AIR FORCE HEADQUARTERS 1ST FIGHTER WING LANGLEY AIR FORCE BASE VA Ms. Brenda W. Cook NOV 15 2005 Chief, Environmental Management Flight 1st Civil Engineer Squadron 37 Sweeney Boulevard Langley AFB, VA 23665 Mr. Gregory F. Sullivan, P.E. Chief, Environmental Management Team NASA Langley Research Center MS 318, Building 1238 Hampton, VA 23681 Dear Mr. Sullivan Thank you for providing Langley AFB the opportunity to review and comment on the Notice of Intent for the NASA New Town Redevelopment environmental assessment (EA). We have no comments on the proposed action at this time, but we request to remain on the distribution list for future deliverables as the environmental impact analysis process continues. We appreciate the opportunity to review and comment on this proposal and look forward to reviewing the preliminary draft EA. Sincerely BRENDA W. COOK, GS-13 Chief, Environmental Management Flight Global Power For America

Response from Virginia Department of Environmental Quality



Mr. Gregory F. Sullivan, P.E. Page 2 agency for Virginia's review of federal consistency determinations and certifications submitted pursuant to the Coastal Zone Management Act. Environmental Review and Scoping Pursuant to the National Environmental Policy Act (NEPA) and its implementing regulations, NASA must prepare an environmental assessment (if the project is not categorically excluded from NEPA) or an environmental impact statement (if the project appears likely to cause significant impacts to the human environment) and make it available for review by the public and by interested federal, state, and local agencies. We are sharing your letter and enclosures with appropriate Virginia reviewing agencies, all of which are free to provide scoping comments independently as the environmental document is being developed. The agencies include the following (note: starred (*) agencies administer one or more of the Enforceable Programs of the Virginia Coastal Resources Management Program; see "Federal Consistency...," below): Department of Environmental Quality: Office of Environmental Impact Review Tidewater Regional Office* Water Division* Air Division* Waste Division Department of Game and Inland Fisheries* Department of Conservation and Recreation: Division of Chesapeake Bay Local Assistance* Division of Soil and Water Conservation* Division of Planning and Recreation Resources Department of Health* Marine Resources Commission* Department of Historic Resources Department of Transportation Hampton Roads Planning District Commission City of Hampton City of Poguoson. In order to ensure an effective coordinated review of the Environmental Assessment (or Environmental Impact Statement), we will require 18 copies of the document when it is published. While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the NEPA documents for the proposed project. Federal Consistency under the Coastal Zone Management Act Pursuant to the Coastal Zone Management Act of 1972, as amended, federal activities affecting Virginia's coastal resources or coastal uses must be consistent with the Virginia Coastal Resources Management Program (VCP), which is the federally approved Virginia coastal management program (see section 307(c)(1) of the Act and

Mr. Gregory F. Sullivan Page 3

the <u>Federal Consistency Regulations</u>, 15 CFR Part 930, sub-part C). NASA must provide a consistency determination which involves an analysis of the activities in light of the Enforceable Policies of the VCP (first enclosure), and a commitment to comply with the Enforceable Policies. In addition, we invite your attention to the Advisory Policies of the VCP (second enclosure). The federal consistency determination may be provided as part of the NEPA documentation or independently, depending on NASA's preference; however, we recommend that the federal consistency determination be made a part of the NEPA document, to save time for NASA and also for the Commonwealth in reviewing the project. Section 930.39 of the <u>Federal Consistency Regulations</u> and Virginia's <u>Federal Consistency Information Package</u> (see below) give content requirements for the consistency determination. Section 930.41(a) allows 60 days for the State to respond to the consistency determination.

DEQ's guidance, known as the <u>Federal Consistency Information Package</u>, is available on DEQ's web site, <u>http://www.deg.state.va.us</u>. Select "Programs" on the left, then scroll to "Environmental Impact Review/Federal consistency." Select "federal consistency reviews" on the left. This gives you access to the document. If you have questions about the environmental review process or the federal consistency review process, please feel free to call me (telephone (804) 698-4325) or Charles Ellis of this Office (telephone (804) 698-4488).

I hope this information is helpful to you.

Sincerely,

ie | Irons

Ellie L. Irons Program Manager Office of Environmental Impact Review

Enclosures

cc: Harold J. Winer, DEQ-TRO Catherine M. Harold, DEQ-DWQ Kotur S. Narasimhan, DEQ-DAPO Allen R. Brockman, DEQ-Wast Andrew K. Zadnik, DGIF Scott Bedwell, DCR Steven Pellei, VDH Tony Watkinson, MRC Ethel R. Eaton, DHR Mary T. Baldwin, VDOT John M. Carlock, Hampton Roa Charles W. Burgess, Jr., City c Gregory Goetz, City of Hampto This page intentionally left blank.

APPENDIX B

DRAFT PROGRAMMATIC AGREEMENT

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PROGRAMMATIC AGREEMENT AMONG THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, THE VIRGINIA STATE HISTORIC PRESERVATION OFFICER, AND THE ADVISORY COUNCIL ON HISTORIC PRESERVATION FOR IMPLEMENTATION OF THE MASTER PLAN, TITLED NEW TOWN, FOR MODERNIZING THE FACILITIES AND INFRASTRUCTURE AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION'S LANGLEY RESEARCH

CENTER, HAMPTON, VIRGINIA

WHEREAS, National Aeronautics and Space Administration Langley Research Center, Hampton, Virginia (NASA LaRC) proposes to implement its Master Plan titled "New Town" (Plan) for modernizing the facilities and infrastructure at NASA LaRC;

WHEREAS, NASA and the General Services Administration (GSA) have partnered together to design and construct the facility improvement project;

WHEREAS, NASA LaRC has determined that implementation of the Plan has the potential to affect properties listed and eligible for listing on the National Register of Historic Places (NRHP);

WHEREAS, NASA's overall Cultural Resource Management (CRM)) Program is managed by the agency's Federal Preservation Officer (FPO), Environmental Management Division, NASA Headquarters who has designated a Historic Preservation Officer (HPO) at each NASA field Center who is responsible for implementing NASA's CRM program, reporting to the FPO and coordinating cultural resource activities at his/her facility;

WHEREAS, NASA LaRC's HPO is responsible for coordinating the internal review of projects and activities that may affect cultural resources and for consulting with external agencies regarding the identification, evaluation and treatment of NASA LaRC's cultural resources (including but not limited to the Virginia Department of Historic Resources, the Advisory Council on Historic Preservation, and the National Park Service);

WHEREAS, the NASA FPO and the NASA LaRC HPO are responsible for ensuring that the NASA LaRC Director and senior management are included, as appropriate, in project planning and decision-making regarding NASA LaRC's cultural resources;

WHEREAS, NASA LaRC has completed a Phase I reconnaissance survey of all buildings and structures 45 years of age or older titled *Phase I Reconnaissance Survey of Architectural Resources at the National Aeronautics and Space Administration, Langley Research Center;*

WHEREAS, Appendix A to this Programmatic Agreement (Agreement) lists all buildings and structures surveyed at NASA LaRC and the Virginia State Historic Preservation Officer's (VASHPO) opinion regarding their potential eligibility for listing in the NRHP (Inventory);

WHEREAS, NASA LaRC has completed Phase I identification surveys for archaeological resources of the facility and has provided the results of these surveys to the VASHPO for review and comment in accordance with its responsibilities under Section 110 of the NHPA, as amended;

WHEREAS, Appendix B to this Agreement lists all previously identified archaeological resources at NASA LaRC and the VASHPO's opinion regarding their potential eligibility for listing in the NRHP;

WHEREAS, NASA LaRC has determined the implementation of the Plan and associated maintenance and rehabilitation programs may affect buildings and structures potentially eligible for listing in the NRHP and has consulted with the VASHPO and the Advisory Council on Historic Preservation (ACHP) pursuant to 36 CFR § 800.6 of the ACHP's regulations (*Protection of Historic Properties*, 36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470f);

NOW THEREFORE, NASA LaRC, the VASHPO, and the ACHP agree that implementation of the Plan and all associated maintenance and rehabilitation programs shall be undertaken in accordance with the following stipulations to satisfy NASA LaRC's Section 106 responsibilities for all individual undertakings.

STIPULATIONS

NASA LaRC will ensure that the following stipulations are carried out:

I. RESOURCE IDENTIFICATION AND EVALUATION

A. Within one (1) year of the execution of this Agreement, NASA LaRC will complete a comprehensive reconnaissance level architectural survey for all resources located at NASA LaRC that are 30 years of age or older at the time of the survey and not previously surveyed. The survey shall be sufficient to determine the potential NRHP eligibility of the surveyed resources.

- 1. Two (2) copies of the survey (draft), including updated Data Sharing System (DSS) software records, will be submitted to the VASHPO for review and comment.
- 2. After consideration of the VASHPO's comments, two (2) copies of the survey (final), including DSS records, will be provided to the VASHPO.
- 3. NASA LaRC, in consultation with the VASHPO, will update the Inventory of buildings and structures attached to this Agreement as Attachment A.

B. NASA LaRC will reevaluate the Inventory and its findings, in consultation with the VASHPO, between the ninth (9th) and eleventh (11th) years after the effective date of this Agreement. The reevaluations shall occur on a ten (10) year cycle for as long as this Agreement shall remain in effect and shall be accepted by NASA LaRC and the VASHPO before they are incorporated into the Inventory included as attachment A to this Agreement.

II. ACTIVITIES EXEMPT FROM REVIEW

A. The activities identified in Appendix C of this Agreement have limited potential to affect historic properties and may be approved by the HPO without further consultation with the VASHPO or the ACHP.

B. Any signatory party to this Agreement may propose additions to the list of exempted undertakings. These undertakings will be added to Appendix B if mutually agreed upon by the signatory parties.

III. TREATMENT OF HISTORIC OR CONTRIBUTING PROPERTIES

Individual properties that are determined eligible for, nominated to, or listed in the NRHP, or properties determined to be contributing elements within the NASA LaRC Historic District, or determined potentially eligible for listing in the NRHP as contributing elements to the NASA LaRC Historic District and included in Attachment A to this Agreement, shall be treated as follows:

A. Adaptive Reuse

Where feasible, historic buildings and structures which no longer support NASA's ongoing programs may be adaptively reused.

B. Rehabilitation

- 1. Rehabilitation of historic or contributing properties will be done in accordance with the recommended approaches in the Secretary's Standards.
- 2. Pre-project documentation including work write-up's, bid documents, architectural plans and photographs, will be prepared by NASA LaRC staff with the responsibility for the project, and in consultation with the HPO or other qualified consultants as appropriate.
- 3. The HPO shall review the rehabilitation plans and issue a Letter of Approval verifying that the project will have no effect or no adverse effect, by virtue of meeting the Secretary's Standards. Work may not begin until a Letter of Approval has been issued by the HPO. All work will conform to the approved proposal and to the conditions stated in the Letter of Approval. Rehabilitation accomplished in this manner will have no adverse effect on historic properties and no further compliance with the ACHP's regulations will be necessary with regard

to the subject project.

- 4. The documentation of each project will be retained by the HPO as part of the permanent project files and may be reviewed by the VASHPO upon request, or as part of the annual report.
- 5. If the Standards cannot be met, or the proposed treatment of the property is not rehabilitation, or if the contemplated action could have an adverse effect on properties eligible for the NRHP, then prior to taking any action, NASA LaRC will consult with the VASHPO and initiate the procedures set forth in 36 CFR § 800.5.
- C. New Construction and Additions
 - New construction within or immediately adjacent to the NASA LaRC Historic District, will be designed to take into account the Secretary's Standards and be responsive to the overall character of the historic district in terms of height, scale, massing, set-backs, color, materials, and detailing as appropriate. Preliminary plans will be sent to the HPO for review and approval. If the HPO determines that the plans are compatible with the NASA LaRC Historic District, the HPO will issue a letter of approval and the project may proceed. If the HPO determines that the plans are not compatible, they will be sent to the VASHPO for review and comment. The VASHPO will provide comments within 15 days of receipt of plans and if no comments are received, it shall be assumed that the plans are approved by VASHPO.
 - 2. Additions to historic buildings or structures or contributing buildings or structures within the NASA LaRC Historic District, shall adhere to the Secretary's Standards and be consistent with guidelines in National Park Service Brief #14, "New Exterior Additions to Historic Buildings: Preservation Concerns." Plans for such additions shall be reviewed and approved by the HPO to ensure consistency with these guidelines.
- D. Handicapped Accessibility

Handicapped accessibility projects undertaken by NASA LaRC to comply with the Americans with Disabilities Act and other local and federal requirements will follow these guidelines:

1. NASA LaRC will explore all alternative methods to provide handicapped accessibility to historic buildings and structures consistent with the Secretary's Standards, the National Park Service's Preservation Brief # 32 "Making Historic Properties Accessible," and the Department of the Interior's report "Access to Historic Buildings for the Disabled: Suggestions for Planning and Implementation."

- 2. To the extent feasible, handicapped accessibility features (e.g. ramps, elevators, etc.) will not be located on primary elevations of historic buildings or structures and will not result in the removal of significant historic or architectural features or materials.
- 3. If handicapped accessibility projects can meet these guidelines, final plans and specifications shall be reviewed and approved by the HPO.
- 4. If the Secretary's Standards cannot be met or if the project could have an adverse effect on an historic property, then prior to taking any action, NASA LaRC will consult with the VASHPO and initiate the procedures set forth in 36 CFR § 800.5.
- E. Sale, Transfer, or Lease
 - 1. Prior to the sale, transfer or lease of property included in Appendix A, NASA LaRC will develop covenant or easement language to be attached to the dead or lease document.
 - 2. NASA LaRC shall provide a copy of the draft covenant or easement language to the VASHPO for review and comment.
 - 3. Upon receipt of comment from the VASHPO, NASA LaRC shall attach the covenant or easement to the dead or lease agreement prior to the sale, transfer, or lease of property.

IV. DEMOLITION

A. Demolition of non-historic or non-contributing properties

NASA LaRC may proceed with demolition of non-historic properties or non-contributing buildings and structures located in the NASA LaRC Historic District and identified in Attachment A to this Agreement, without further review of the VASHPO or ACHP. NASA LaRC shall retain documentation of all such demolitions in its project files. No demolition may proceed until the HPO has issued a Letter of Approval.

B. Demolition of historic or contributing buildings and structures

- 1. Prior to the demolition of historic properties not covered under stipulation V(C) (emergency demolition provision) of this Agreement, the HPO shall forward the following documentation to the VASHPO:
 - a. location and description of the building or structure;
 - b. reasons for demolition, including documentation of structural damage or obsolescence, deterioration, and an explanation of why rehabilitation or reuse is neither prudent nor feasible;

- c. recent photographs of each elevation and any significant architectural or structural elements;
- d. measures taken to solicit public comment;
- e. a summary of alternatives considered;
- f. future plans for the property if they have been developed; and
- g. proposed Standard Mitigation Measures as outlined in Appendix D to this Agreement
- 2. The VASHPO will review the documentation submitted and *within 15 days* of receipt of adequate documentation, will either concur or object in writing to the proposed demolition and proposed standard mitigation measures. If the VASHPO concurs that demolition is the only feasible alternative and the standard mitigation measures are acceptable, then NASA LaRC will proceed with the proposed demolition. If the VASHPO objects to the demolition and the proposed standard mitigation measures, then NASA LaRC shall consult with the VASHPO and ACHP in accordance with the procedures set for in 36 CFR § 800.5.
- C. Emergency Demolition
 - 1. In the event NASA LaRC determines that emergency demolition of a historic property or contributing property within a historic district is required to avoid an imminent threat to human health and safety, NASA LaRC shall deliver documentation to the VASHPO and request comments within five (5) business days. The documentation shall include:
 - a. A copy of the order requiring emergency demolition;
 - b. Photographs of the property current condition;
 - 2. The VASHPO will notify NASA LaRC in writing of its acceptance of any agreed upon mitigation measures (i.e. recordation, additional photographic documentation, architectural salvage, etc.). If the VASHPO objects to the demolition, NASA LaRC will comply with the ACHP's regulations at 36 CFR § 800.12 regarding emergency situations.

V. ARCHAEOLOGY

A. In the event NASA LaRC plans ground disturbance as part of a rehabilitation, new construction, site improvement, or other project, in an area with a previously identified archaeological resource listed in Appendix B and the resources is potentially eligible for or listed in the NRHP, NASA LaRC will consult with the VASHPO on ways to avoid,

minimize, or mitigate potential effects to the identified resource. All work in areas where no resources are identified, may proceed without further consultation with the VASHPO.

B. If NASA LaRC determines that it is not feasible to preserve or avoid the archaeological resources, NASA LaRC will consult with the VASHPO to develop a treatment plan consistent with the *Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* (Federal Register 48:44716-44742, September 29, 1983) and the VASHPO's *Guidelines for Archaeological Investigations in Virginia* (rev. 2003).

C. NASA LaRC will submit the treatment plan to the VASHPO for review and comment. Upon receipt of VDHR's comments, NASA LaRC will revise and implement the treatment plan.

D. If the VASHPO objects to the proposed treatment plan or its manner of implementation, NASA LaRC will request the comments of the ACHP in accordance with 36 CFR § 800.6(b)(1)(v).

VI. REVIEW AND COORDINATION

A. The HPO will ensure that the appropriate staff at NASA LaRC are aware of the Agreement and associated written guidance.

B. All project documentation will be prepared NASA LaRC staff with responsibility for the proposed project, in consultation with the HPO and in accordance with Section IV of this Agreement.

- 1. The HPO will review the project documentation and issue a Letter of Approval for each undertaking if it meets the Secretary of the Interior's Standards. No work may begin until such letter has been issued.
- If the HPO determines that the project does not meet the Secretary of the Interior's Standards or will have an adverse effect on historic properties, the HPO shall consult with VASHPO, and if necessary the ACHP in accordance with 36 CFR § 800.6.

C. Project documentation prepared for review under this Agreement shall be submitted to the VASHPO in an electronic format such as a .pdf file. This shall include photographs, maps, text, plans, and other data as required.

D. NASA LaRC shall submit electronic documentation via e-mail from the HPO during regular working hours with an e-mail delivery confirmation receipt requested. Review and comment periods specified in this Agreement shall commence upon confirmation of e-mail receipt.

VII. PUBLIC BENEFIT AND EDUCATION

A. A variety of public interpretation initiatives may be undertaken for the purpose of historic preservation. These include, but are not limited to:

- 1. Web-based products for children and adults featuring the historic property as part of the heritage of NASA-LaRC. This product will be hosted on NASA's website for millions around the world to experience.
- 2. Reports and pamphlets suitable for the general public describing the historic property and its role in the U.S. Space Program.
- 3. Collection and assembling of documents including testing schedules, technical reports, public relations materials, historic photographs, engineering drawings, maps, etc.
- 4. Identification, collection, preservation, and display of significant objects relating to the history of NASA LaRC, including tools, instruments, scale models, clothing, etc.
- 5. The systematic collection of oral histories from long-term NASA LaRC employees, providing information on worker life and social history not available in written sources.

B. In keeping with the National Aeronautics and Space Act of 1958 which charges NASA with the development of public education and outreach programs, NASA LaRC may undertake the following through its cooperative agreement with the Virginia Air and Space Museum, as well as other established partnerships:

- 1. Provide support for research and written popular and technical histories and other accounts;
- 2. Provide support for the existing offices of Agency historians and archivists to further the increased dissemination of historical documentation and official agency histories already available but little known outside of NASA;
- 3. Foster opportunities for public/private partnerships to preserve the tangible elements of America's manned space program, including sponsorship of "adopt an artifact" programs to share pieces of NASA LaRC's history with public institutions.

IV. ADMINISTRATIVE PROVISIONS

- A. Professional Standards and Qualifications
 - 1. All archaeological studies, resulting from this Agreement, including data recovery plan(s), shall be consistent with the *Secretary of the Interior's Standards and Guidelines for Archeological Documentation (48 FR 4434-37)* and the

VASHPO's Guidelines for Conducting Cultural Resource Survey in Virginia: Additional Guidance for the Implementation of the Federal Standards Entitled Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (48 FR 44742, September 29, 1983) 1999, rev. 2003), and shall take into account the ACHP's publications, Recommended Approach for Consultation on Recovery of Significant Information from Archeological Sites (1999) and Section 106 Archaeology Guidance (June 2007).

- 2. All archaeological work carried out pursuant to this Agreement shall be conducted by or under the direct supervision of an individual or individuals who meet, at a minimum, the qualifications for archaeology set forth in the Secretary of Interior's *Professional Qualifications Standards* (62 FR 33707, June 20, 1997).
- 3. All historical and architectural studies resulting from the Agreement shall be consistent with pertinent standards and guidelines of the Secretary of the Interior, including as applicable the Secretary of the Interior's *Standards and Guidelines for Historical Documentation* (48 FR 44728-30) and for *Architectural and Engineering Documentation* (48 FR 44730-34).
- 4. All evaluations of buildings or structures shall be carried out by or under the supervision of an individual or individuals who meet, at a minimum, the qualifications for architectural history set forth in the *Professional Qualifications Standards* while all design work on historic buildings and structures shall be carried out by or under the supervision of an individual or individuals meeting the qualifications for historic architecture set forth in the *Professional Qualifications Standards*.
- **B.** Post Review Discoveries
 - 1. NASA LaRC shall ensure that contracts for activities involving ground disturbance and/or construction contain the following provisions for the treatment of post review discoveries:
 - a. In the event that a previously unidentified archaeological resource is discovered during ground disturbing activities, all construction work involving ground disturbance shall be halted in the area of the resource and in any areas where the resource can reasonably be expected to occur. An archaeologist meeting the Secretary of the Interior's *Professional Qualifications Standards* shall inspect the work site and determine the extent and the nature of the affected archaeological property. Construction work may then proceed in the Project Area outside of the area of discovery.
 - b. NASA LaRC shall then proceed in accordance with 36 CFR Part 800.13(b)(3).

- c. If the resource is determined by NASA LaRC in consultation with the VASHPO to meet the National Register Criteria (36 CFR 60.6), NASA LaRC shall ensure compliance with 36 CFR 800.13.
- d. If human remains and associated funerary objects are discovered, NASA LaRC shall immediately halt work in the area and contact the appropriate authorities. If the remains are determined to be Native American, NASA LaRC will comply with the provisions of the Native American Graves Protection and Repatriation Act as appropriate. If the remains are determined not be Native American, NASA LaRC shall comply with the *Virginia Antiquities Act*, Section 10.1-2305 of the *Code of Virginia*, final regulations adopted by the Virginia Board of Historic Resources and published in the Virginia Register on July 15, 1991.
- e. NASA LaRC shall ensure that archaeological artifacts recovered from archaeological investigations or post review discoveries will be stored in a curatorial repository that meets federal standards stipulated in 36 CFR Part 79, "The Curation of Federally Owned and Administered Archaeological Collections."
- f. NASA LaRC will notify the VASHPO and other parties as appropriate, at the earliest possible time, if an effect to a known historic property occurs in an unanticipated manner. NASA LaRC shall then consult with the VASHPO to develop actions to avoid, minimize, and/or mitigate further effects to the historic property from the proposed activity. After such consultation, NASA LaRC shall notify the VASHPO and other appropriate parties as to its final decision.

C. Dispute Resolution

- 1. Should any signatory to this Agreement object to any action carried out or proposed by NASA LaRC with respect to implementation of this Agreement, NASA LaRC will consult with the objecting party to resolve the objection.
- 2. If after initiating such consultation NASA LaRC determines that the objection cannot be resolved through consultation, NASA LaRC shall forward all documentation relevant to the objection to the ACHP, including the proposed response to the objection.
- 3. Within 45 days after receipt of all pertinent documentation, the ACHP shall exercise one of the following options:
- 4. Advise NASA LaRC that the ACHP concurs in the proposed response to the objection, whereupon NASA LaRC shall respond to the objection accordingly;
- 5. Provide NASA LaRC with recommendations, which NASA LaRC shall take into

account in reaching a final decision regarding its response to the objections; or

- 6. Notify NASA LaRC that the objection will be referred for ACHP comment pursuant to 36 CFR Part 800.7(c), and proceed to refer the objection for comment. Any ACHP comment rendered pursuant to this stipulation shall be understood to apply only to the subject of the objection; all other responsibilities of the parties stipulated in agreement shall remain unchanged.
- 7. Should the ACHP not exercise one of the above options within 45 days after receipt of all pertinent documentation, NASA LaRC may assume the ACHP's concurrence in its proposed response to the objection and make a final decision on how to respond to the objection.
- 8. At any time during implementation of the measures stipulated in this Agreement, should an objection pertaining to this Agreement be raised by a member of the public, the party to this Agreement receiving the objection shall notify the other parties to this Agreement and NASA LaRC will take the objection into account, consulting with the objector and, should the objector so request, with any of the parties to this Agreement to resolve the objection.
- **D.** Emergency Actions
 - 1. Emergency actions are those actions deemed necessary by NASA LaRC as an immediate and direct response to an emergency situation, which is a disaster or emergency declared by the President, tribal government, or the Governor of the State, or other immediate threats to life or property. Emergency actions under this Agreement are only those implemented within 30 days from the initiation of the emergency situation.
 - 2. If the emergency action has the potential to affect historic properties, NASA LaRC shall notify the VASHPO and other parties as appropriate prior to undertaking the action, when feasible. As part of the notification, NASA LaRC shall provide a plan to address the emergency. The VASHPO shall have 7 business days to review and comment on the plan to address the emergency. If the VASHPO does not comment or object to the plan within the review period, NASA LaRC shall implement the proposed plan.
 - 3. If NASA LaRC is unable to consult with the VASHPO prior to carrying out emergency actions, NASA LaRC shall notify the VASHPO and other parties as appropriate within 48 hours after the initiation of the emergency action. This notification shall include a description of the emergency action taken, the effects of the action(s) to historic properties, and, where appropriate, any further proposed measures to avoid, minimize, or mitigate potential adverse effects to historic properties. The VASHPO shall have 7 days to review and comment on the proposal where further action is required to address the emergency. If the VASHPO does not object to the plan within the review period, NASA LaRC shall

implement the proposed plan.

- 4. Where possible, such emergency actions shall be undertaken in a manner that does not foreclose future preservation or restoration of historic properties. Where such emergency actions may affect historic buildings or structures, they shall be undertaken in a manner that is consistent with the *Standards*. In addition, where possible, such actions will be done with on-site monitoring by the appropriate preservation professional who meets, at a minimum, the *Professional Qualifications Standards* in his or her field of expertise.
- 5. Where the VASHPO and/or any other party has reason to believe that a historic property may be adversely affected by an emergency action, the party shall submit a request to NASA LaRC to review and comment on that action.
- 6. Immediate rescue and salvage operations conducted to preserve life or property are exempt from these and all other provisions of this Agreement.

E. Annual Reporting

NASA LaRC shall provide an annual status report within 12 months of the execution of this Agreement, and every 12 months thereafter, to the VASHPO to review implementation of the terms of this Agreement and to determine whether amendments are needed. Annual reports shall be prepared by NASA LaRC and submitted to the VASHPO.

- F. Amendment and Termination
 - 1. Amendment

Any signatory to the Agreement may request that this Agreement be amended, whereby the signatories shall consult to consider whether such amendment is necessary. Any amendment to this Agreement shall become effective upon the signature of all the signatories.

2. Termination

Any signatory to the Agreement may terminate this Agreement by providing 30 days written notice to NASA LaRC and the other signatory parties. During the period after notification and prior to termination, NASA LaRC and the other signatories shall consult to seek agreement on amendments or other actions that would avoid termination. In the event of termination, NASA LaRC shall negotiate a new PA per 36 CFR Part 800.14(b), or request, consider, and respond to ACHP formal comments per 36 CFR Part 800.7.

G. Anti-Deficiency Act

The stipulations of this Agreement are subject to the provisions of the Anti-Deficiency Act. If compliance with the Anti-Deficiency Act alters or impairs NASA LaRC's ability to implement the stipulations of this Agreement, NASA LaRC shall consult in accordance with the amendment and termination procedures found at Stipulations IV(F)(1) and IV(F)(2) of this Agreement.

H. Duration

The effective date of this Agreement shall be the date of the last signature of the signatories. This Agreement shall remain in full force and effect for twenty (20) years after the date of the last signatory's signature. Twenty-four (24) months prior to the expiration of the Agreement, the signatories will consult and determine whether the Agreement needs to be extended, amended, or terminated and take such actions as appropriate.

Execution and implementation of this Agreement evidences that NASA LaRC has taken into account the effects of the undertaking on historic properties and has afforded the ACHP a reasonable opportunity to comment on the undertaking.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY RESEARCH CENTER

I	Date:
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Lesa B. Roe, Director

ADVISORY COUNCIL ON HISTORIC PRESERVATION

John M. Fowler, Executive Director

VIRGINIA STATE HISTORIC PRESERVATION OFFICER

Date:_____

Date:____

Kathleen S. Kilpatrick, Director

APPENDIX A Inventory of NASA LaRC Resources as of June 2008

[Not included]

APPENDIX B Archaeological Resource Inventory and NRHP Determination As of June 2008

[Not included]

APPENDIX C: Actions That Do Not Require Consultation with VASHPO or ACHP

The following categories of undertakings are considered to have little or no effect to historic properties and do not require consultation with the VASHPO or ACHP to implement provided such undertakings do not alter or detract from the qualities that contribute to the significance of an historic property.

- 1. **New building construction:** New construction within NASA LaRC's historic district which is potentially eligible for listing in the NRHP, provided such new construction does not directly impact contributing resources. *Consultation with the SHPO required when construction proposed on previously undisturbed ground to ensure archaeological properties will not be adversely affected.*
- 2. **Facility removal or replacement:** Removal or replacement of existing non-historic equipment or facility components where the equipment or component itself is not a feature which contributes to the historic significance of the historic property(ies) identified in Appendix A.
- 3. **Building maintenance and repair:** General maintenance and repair of buildings and facilities. Includes, but is not limited to, painting; siding; roofing; door, ceiling, wall, window, floor covering repair/replacement; elevator repair; filter and light replacement; and repairs to existing equipment. If historic fabric must be replaced, it should be in-kind and match as practicable the configuration, material, size, detail, and construction of the historic fabric as called for in the *Secretary of the Interior's Standards for Rehabilitation*.
- 4. **Building removal**: Demolition of buildings, structures, or facilities that are either not historic properties listed in Appendix A, or do not contribute to the significance of an Appendix A historic property, whether or not it lies within LaRC's Historic District.
- 5. **Retrofitting:** May include placement, installation, maintenance, repair, removal or replacement of communications and computer systems, including public address systems, facsimile systems, microwave/radio systems, fiber-optic cables, and phone systems. *Properties historically significant in the context of communications require prior consultation with the VASHPO should retrofitting affect historically significant fabric.*
- 6. **Fire detection/suppression:** Changes, modifications, or upgrades to fire detection/ suppression systems, fire alarm systems, smoke detectors, and suppression/sprinkler systems in all NASA LaRC buildings and facilities. *Changes that may affect those historic qualities of a property require prior consultation with the VASHPO*.
- 7. **Lighting:** Changes to interior and exterior lighting systems including replacement of or modification to lighting systems in all NASA LaRC buildings and facilities.

- 8. Electrical: Maintenance, repair, removal, modification, upgrading or replacement of plant and building electrical systems (e.g., building conduit, wiring and lighting, emergency lighting, etc.) in all NASA LaRC buildings and facilities. Upgrading or addition of new electrical lines between or among buildings within LaRC's Historic District so long as there is no change in existing pole configuration.
- 9. Water systems: Changes to water systems including placement, installation, maintenance, repair, removal, and operation of plant water systems including, but not limited to: water wells, cooling water systems, potable water systems, storm sewers, waste water treatment systems, plant drainage, and plumbing. *Replacement of sewers and drains not on original location requires consideration for archaeological resources and may require consultation with VASHPO*.
- 10. **Energy conservation:** Installation, replacement, or upgrading of HVAC systems, including modifications to the HVAC control systems and conversions to alternative fuels provided that these elements do not affect historic fabric.
- 11. **Health and safety activities:** Clean-up, encapsulation and removal/disposal of asbestoscontaining materials and lead paint from all non-historic buildings and structures. *Buildings and structures listed in Appendix A require prior consultation with the VA SHPO should historically significant fabric be targeted.*
- 12. **Temporary facilities:** Construction or placement of temporary structures and sheds that do not physically affect historically significant properties or involve new ground disturbance.
- 13. **Parking:** Parking lot maintenance and repair of existing lots. Temporary parking or placement of mobile homes, tents, and portable structures on extant parking lots or other surfaces that do not require new ground disturbance.
- 14. **Roads:** Routing, road maintenance, and resurfacing where work is confined to previously maintained surfaces, ditches, culverts, and cut and fill slopes where there are no known historic properties or historic properties would not be affected because the proposed work is clearly within a disturbed context. Includes paving extant roads or parking lots, or placing marl or shell on dirt roads or lots; small-scale roads, sidewalks, and parking lot repair. Adding rock fill or gravel to roads where no new ground disturbance will occur. *Consultation with the VASHPO required when new road construction is proposed in areas where archaeological resources are identified or expected to ensure archaeological properties will not be adversely affected.*
- 15. Landscaping: Mowing and trimming of grass, shrubs, or trees; routine vegetation control activities, including tree planting and noxious weed eradication.
- 16. **Erosion control:** Erosion control activities such as gravel or riprap placement on slopes, planting or seeding ground cover, cleanout of existing drainage ditches. *Consultation*

with the VASHPO required when erosion control measures are proposed in areas with previously recorded or suspected archaeological resources to ensure archaeological properties will not be adversely affected.

- 17. **Fencing:** Maintenance of existing fencing and installation of new chain link or post and rail fencing.
- 18. **Signage:** Placement of signage and public interpretation including the use of interpretive signs or exhibit structures that do not visually adversely affect an historic property.
- 19. **Hurricane modifications:** Modifications necessary to comply with hurricane codes. *Changes that may affect those historic qualities of a property require prior consultation with the VASHPO.*
- 20. **Green building technologies:** Incorporation of green building technologies to existing buildings seeking certification under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) or other applicable standards for environmentally sustainable construction, *provided such construction does not alter or detract from the qualities that contribute to the significance of the historic property.*
- 21. Wildlife habitat conservation: Maintenance of existing property, wetlands and stream channels. Installation of nesting platforms and boxes. Installation of animal-secure fencing or barriers when consistent with fencing provision above. *Consultation with the VASHPO required if new or expanded wetlands are proposed to ensure archaeological properties will not be adversely affected.*
- 22. Antiterrorism and force protection measures: Antiterrorism measures designed and constructed to prevent or mitigate hostile actions, including cyber threats, as well as to increase capacity and protection for access control. *Requires prior consultation with the VASHPO when activities will disturb previously recorded or suspected archaeological properties to ensure archaeological properties will not be adversely affected.*
- 23. **Transfer of real estate:** Transfer of ownership or management responsibilities of real property (including those listed in Appendix A) to management by another Federal agency with equal responsibility for complying with Sections 106 and 110 of the NHPA.

APPENDIX D Standard Mitigation Measures

A. Properties determined eligible for inclusion in the NRHP as contributing to the NASA LaRC Historic District and are eligible only under Criterion A.

Completion of documentation in accordance with the VASHPO's DSS Intensive Level Survey requirements. Such documentation shall include a detailed architectural description of the property (exterior and interior), detailed floor plan, photographs of exterior and interior views, and background history.

B. Properties determined eligible for inclusion in the NRHP as contributing to the NASA LaRC Historic District and are eligible under Criterion C.

Completion of documentation to include: a sketch plan, photographs with largeformat negatives of exterior and interior views, and the short form for historical reports.

C. Properties determined individually eligible for inclusion in the NRHP.

- 1. Completion of documentation to include: photograph with large format negatives or photographically reproduced on Mylar in accordance with the U.S. Copyright Act, as amended select existing drawings, where available, photographs with large-format negatives of exterior and interior views, or historic views where available, and written data to include property history and description.
- 2. Salvage of architectural or scientific/engineering elements from historic properties where appropriate. NASA LaRC will ensure that salvage will not be undertaken without prior documentation. Qualified professionals meeting the Secretary of the Interior's *Professional Qualifications Standards* shall survey the historic property to identify if any artifacts or structural elements are worthy of salvage for preservation purposes. NASA LaRC shall ensure that the items selected are removed in a manner that minimizes damage. NASA LaRC will apply its agreement with the Smithsonian Institution ("Agreement Between the National Aeronautics and Space Administration and the Smithsonian Institution Concerning the Transfer and Management of NASA Historical Artifacts, May 28, 1998" as set forth in NASA Policy Directive [NPD] 4310.1 dated May 28, 1998) to determine appropriate retention and curation activities with respect to significant artifacts.

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APPENDIX C

STRATEGIC CONCEPT PLAN FOR NEW TOWN June 28, 2005

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NASA Langley Research Center (LaRC) has embarked on a bold planning initiative to strategically reposition its physical facilities and research campus for the 21st Century. This initiative started with the *Facilities Plan: Needs Assessment & Investment Options* study prepared in 2004, demonstrating that a targeted program for repairing and replacing aging facilities with new state-of-the-art facilities can be economically viable. Based upon those early results, this *Strategic Concept Plan for New Town* was developed, providing a more detailed, phased redevelopment plan for upgrading Langley's facilities. The Plan, referred to as 'New Town', is a mix of renovation and new construction within a re-oriented campus; a Plan that focuses on the future requirements of Langley while maintaining its tradition for technical excellence. Specific objectives achieved through New Town include:

- 1. *Cost-Effective Strategy:* New Town provides an economically viable approach for modernizing facilities through a 'repair-by-replacement' program, using a mix of renovation and new construction, balanced with significant demolition of the worn-out facilities.
- 2. Focus on the Future: New Town employs a master plan approach that focuses on the future of the Center, incorporating sustainable design concepts that accommodate change while enhancing the value and performance of existing assets.

3. Upgrade Facilities: New Town provides new and renovated facilities

that fully support Langley's objectives for space efficiency, flexibility, and state-of-the-art systems.

- 4. *Reduce O&M Costs:* New Town will reduce the operations and maintenance burden of the aging campus by reducing overall building square footage through a selective program of demolition and construction.
- 5. *Flexible Implementation:* New Town can be implemented in phases based upon available funding, with little or no need for temporary swing space.

The first objective is to provide an economical approach for modernizing the aging Langley facilities. Since the majority of facilities were constructed in the 1950s and early 1960s, many require significant investment to upgrade and sustain them in reliable working order. An alternative to investing in extensive repairs is to demolish the worst of the buildings, repair those that are in reasonable condition and flexible for reconfiguration, and construct new buildings as needed to support the program over the next twenty-five (25) years. With a Net Present Value of \$147 million, this program will yield a projected Savings-to-Investment Ratio (SIR) of 1.4 and a Discount Payback Period (DPP) of 12.3 years, comparing well with industry thresholds for investment and NASA target standards.

The second objective is to provide a master plan framework for the facilities investment that builds upon the extensive resources and infrastructure already in place, while giving Langley a new focus for the future. Central to this master plan is the consolidation of new and renovated facilities within the core 'New Town' area. By achieving greater mass within the core area, New Town will bring more life and energy to the core, and make it easier for staff and visitors to walk between buildings (rather than drive). It also brings a logic and order to the overall site plan, while reserving specific areas of the campus for other uses or investment opportunities.

The next objective of New Town is to upgrade the facilities so that they can fully support Langley's mission. For administrative facilities, this means offices that can meet the operational demands of Langley, while achieving NASA's space utilization goals for optimal efficiency. For research laboratories, it means state-of-the-art building systems, provided in a flexible workspace environment that can be easily reconfigured to accommodate changing missions and technology. For special-use space (i.e. conferencing and food service), it means raising the quality of life for the staff and visitors at the Center, and giving Langley the tools to attract the best scientific talent to its world-class facilities.

EXECUTIVE SUMMARY

LaRC Today



The fourth objective focuses on the overall dependability of the facilities, and the ever-increasing operational and management costs associated with maintaining them at an acceptable level of readiness. The annual Operations and Maintenance (O&M) costs to maintain Langley's facilities exceeds current funding, and has for several years. In response to this, the New Town Plan will demolish approximately 528,000 gross square feet (GSF) of Langley's aging building stock, and build 394,000 GSF of new construction as well as renovate 72,000 GSF. This reduced square footage, along with an overall upgrade in facilities, will significantly reduce the annual O&M burden for the Center.

The final objective of New Town is to be able to implement the plan expeditiously, or, depending on the available funding, phase the design and construction over a fifteen (15) year period (as illustrated in this Study) to minimize the need for major capital funds in any single year. Since New Town is not one big building, but multiple research and administrative buildings strategically located throughout the campus core, the program can accommodate various implementation and funding scenarios with minimum impact on the overall operations of the Center. Concurrent with the new construction and renovation, is the phased demolition of deteriorated and underutilized facilities located throughout the campus.

The Strategic Concept Plan for New Town is made up of six (6) distinct components as follows:

- 1. Housing Master Plan. This Plan looks at the Center's population and associated space needs projected over the next fifteen (15) years. It utilizes the Center's 'best guess' as to future workload and assignment, incorporating significant staff reductions as a result of decreasing budgets. (See Appendix I for detailed analysis.)
- 2. Facilities Evaluation. Drawing from previous facilities assessments, this evaluation verifies the actual conditions of many of the facilities, and quantifies the costs for critical upgrades. The assessment also looks at the overall flexibility of the buildings, and their ability to accommodate new programs. (See Appendix II for detailed analysis.)
- 3. Master Plan. This Plan utilizes the housing and facility requirements determined above, and incorporates them into a phased program for redevelopment.
- 4. Cost/Benefit Analysis. Refining the Econpack financial model first used in 2004 to evaluate multiple future NASA housing options, the master plan reinvestment scenario is phased over a fifteen (15) year period to allow for a variety of implementation priorities and funding possibilities. (See Appendix II for Econpack results.)

- enhanced-use lending, etc.
- (See Appendix II.)

LaRC in the Future

5. Alternative Funding Approaches. This section outlines various funding alternatives that may be considered when financing this project, including: staged government funding, public/private ventures,

6. Preliminary Program of Requirements. This provides preliminary design guidelines for directing the phased development of New Town.

Aerial of Langley Research Center, Hampton, VA



PROJECT TEAM

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EXECUTIVE S

TABLE OF CO

- I. HOUSING MA Summary Table Langley Resea Summary Table Summary Table Total Area Person Projected Pop
- II. FACILITIES EV Langley Camp

III. MASTER PLA

Evolution of N Map of New T Map of Road View of New N View into New Proposed Adn Planned Shar Projected Fun Diagram of th Gantt Schedu New Town Dei Phase 1 - Dem Phase 2 - Step Phase 2 - Step Phase 3 - Dem Phase X

IV. COST/BENEF Annual Opera Cumulative Op Economic Ana

V. ALTERNATIV

APPENDIX I Housing Maste

APPENDIX II Facilities Evalu

Cost/Benefit A Alternative Fu Preliminary Pro Powerpoint Pro

Contact: Terence Williams, PE Scott Rynearson, PE, PM

Eric Smart Pam DuBois Tom Quenville, PM Rodney Harris

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Housing Master Plan Description and Objective

The Housing Master Plan, the first of five (5) sections in the Strategic Concept Plan for New Town, outlines the current spatial utilizations at the NASA Langley Research Center (LaRC) as well as essential information related to staff projections and space requirements for the New Town Concept Plan. Information on population trends and space requirements for the next fifteen (15) years was assessed in five-year increments, starting in 2005 and ending in 2020. The space requirements include information at the macro level for office space, laboratories, office support areas, and shared facilities for the Center. This housing program information was instrumental in outlining the space requirements essential for the planning of new facilities within the New Town Core Area. (See adjacent chart for the summary (continued on pages 5-6), and Appendix I for the complete Housing Master Plan report.)

Data Gathering Process

Detailed questionnaires were distributed to representatives from each Directorate or Office on the LaRC campus. (See Organizational Chart below.) Primary information requested in the Questionnaire related to the number of civil servants and contract personnel as well as space requirements for office, laboratory and common spaces. Additionally, secondary information such as existing location, interaction/relationship





LINIT/ OFFICE	CODE	PERSONNEL		NET PERSO	NET AREA PERSONNEL		TOTAL AREA PERSONNEL		SUPPORT AREA (SF)		REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
CORPORATE UNIT											
Office of the Director	А	12	8	2,110	1,550	2,996	2,201	2,375	2,375	5,371	4,576
SUBTOTAL PERSO	NNEL & USF	12	8	2,110	1,550	2,996	2,201	2,375	2,375	5,371	4,576
SUMMARY A1-AH AND OIG											
		DEDQ		NET	AREA	TOTAL	AREA				
UNIT/ OFFICE	CODE			PERS	ONNEL	PERSO	ONNEL				
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
HEADQUARTER FUNCTION UNIT	1 1		1			i		1	1		
Science Support Office	A1	11	7	1,890	1,250	2,684	1,775	3,138	1,100	5,821	2,875
Wind Tunnel Facility Group Office	A2	1	1	250	250	355	355			355	355
Aviation Safety & Security Program Office	A3	11	7	2,260	1,470	3,209	2,087	2,644	1,519	5,853	3,606
Independent Program Assessment Office	AH	27	34	3,160	3,860	4,487	5,481	1,313	1,313	5,800	6,794
SUBTOTAL PERSO	NNEL & USF	50	49	7,560	6,830	10,735	9,699	7,094	3,931	17,829	13,630
Office of Inspector General		12	12	2,160	2,160	3,067	3,067			3,067	3,067
SUBTOTAL PERSO	NNEL & USF	12	12	2,160	2,160	3,067	3,067			3,067	3,067
SUMMARY B1-B7	-										
UNIT/ OFFICE	CODE	PERS	ONNEL	NET PERSO	AREA ONNEL	TOTAL PERSO	AREA	SUPPORT	AREA (SF)	TOTAL A	REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
SHARED SERVICES UNIT											
Office of Procurement	B1	90	63	10,260	7,320	14,569	10,394	7,706	7,019	22,275	17,413
Office of Chief Council	B2	21	14	3,360	2,260	4,771	3,209	3,438	1,906	8,209	5,115
Office of Equal Opportunity Programs	B3	5	3	810	530	1,150	753	1,044	731	2,194	1,484
Office of Human Resources	B4	47	32	7,250	5,270	10,295	7,483	47,888	11,828	58,183	19,311
Office of Communications & Education - Communications Only	B5	33	25	3,850	2,890	5,467	4,104	47,324	2,750	52,791	6,854
Office of Communications & Education - Education Only	B5	59	45	6,530	4,890	9,273	6,944	4,750	4,750	14,023	11,694
Office of Chief Financial Officer	B6	136	98	15,160	10,970	21,527	15,577	2,938	1,313	24,465	16,890
Office of Chief Information Officer	B7	275	164	30,320	18,820	43,054	26,724	103,591	49,293	146,646	76,017
SUBTOTAL PERSO	NNEL & USF	666	444	77,540	52,950	110,107	75,189	218,678	79,589	328,784	154,778
SUMMARY C1-C4											
	CODE	PERS	ONNEL	NET PERSO	AREA ONNEL	TOTAL PERSO	AREA	SUPPORT	AREA (SF)	TOTAL A	REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
STRATEGIC MANAGEMENT UNIT											
NASA Engineering & Safety Center	C1	64	62	8,190	7,690	11,630	10,920	1,813	1,813	13,442	12,732
Safety & Mission Assurance Office	C2	52	35	4,930	3,550	7,001	5,041	13,720	2,300	20,721	7,341
Strategic Partnership, Planning & Management Office	C3	23	15	2,530	1,650	3,593	2,343	1,188	875	4,780	3,218
Systems Management Office	C4	10	7	1,790	1,250	2,542	1,775	1,950	638	4,492	2,413
SUBTOTAL PERSO	NNEL & USF	149	119	17,440	14,140	24,765	20.079	18,670	5,625	43,435	25,704
SUMMARY D1										,	
		DEDS		NET							REA (SE)
UNIT / OFFICE	CODE	2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
	D1	171	126	18520	13620	26208 4	10340 4	1625	1625	27023 /	20065 4
		171	120	18 520	13 620	26 298	19 340.4	1 625	1 625	27 923.4	20303.4
SUBTOTAL PERSO	THEL & USP	171	120	10,520	13,020	20,230	13,340	1,020	1,025	21,523	20,505

SUMMARY A

HOUSING MASTER PLAN SUMMARY

Data used as the basis for the Housing Master Plan was gathered though a combination of surveys, interviews and site visits over a period of several months by the Leo A Daly programming team, in conjunction with key General Services Administration (GSA) and LaRC personnel.

Langley Research Center Organizational Chart

SUMMARY D2 (Core Resource Unit)											
BRANCH/ OFFICE	CODE	PERSONNEL		NET PERS	AREA ONNEL	TOTA PERSO	LAREA ONNEL	SUPPORT	AREA (SF)	TOTAL A	REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
SYSTEM ENGINEERING DIRECTORATE											1
System Engineering Director's Office	D2	13	11	2,240	1,960	3,181	2,783	1,438	1,438	4,618	4,221
Aeronautical Systems Engineering Branch (ASEB)	D201	50	34	5,240	3,560	7,441	5,055	9,863	9,863	17,303	14,918
Mechanical Systems Branch (MSB)	D202	23	16	2,460	1,760	3,493	2,499	1,375	1,375	4,868	3,874
Electronic Systems Branch (ESB)	D203	35	23	4,140	2,780	5,879	3,948	7,075	7,325	12,954	11,273
Passive Sensor Systems Branch (PSSB)	D204	23	15	2,380	1,580	3,380	2,244	11,195	11,195	14,575	13,439
Exploration Systems Engineering Branch (ESEB)	D205	46	32	5,000	3,680	7,100	5,226	4,188	4,188	11,288	9,413
Structural & Thermal Systems Branch (STSB)	D206	26	16	2,760	1,760	3,919	2,499	1,250	1,250	5,169	3,749
Software Systems Branch (SSB)	D207	24	16	2,480	1,680	3,522	2,386	2,000	2,000	5,522	4,386
Active Sensor Systems Branch (ASSB)	D208	28	20	2,880	2,080	4,090	2,954	9,898	9,898	13,987	12,851
Instrument Systems Engineering Branch (ISEB)	D209	29	19	3,080	1,980	4,374	2,812	1,300	1,300	5,674	4,112
System Integration & Test Branch (SITB)	D210	31	20	3,260	2,160	4,629	3,067	1,275	1,275	5,904	4,342
Advanced Engineering Environments Branch (AEEB)	D211	42	28	4,360	2,960	6,191	4,203	1,525	1,525	7,716	5,728
Aerospace Composite Models Development Branch	D212	35	25	3,740	2,660	5,311	3,777	23,188	23,188	28,498	26,965
Metallic Test Article & Precision Machining (MTAGPMB)	D213	40	28	4,240	2,960	6,021	4,203	27,875	27,875	33,896	32,078
Quality Assurance & Inspection Branch (QAIB)	D214	8	6	880	680	1,250	966	1,200	1,200	2,450	2,166
Technology Development & Integration Branch (TDIB)	D215	56	39	5,840	4,060	8,293	5,765	49,496	49,496	57,789	55,261
Fabrication Business & Contracts Mgmt Branch (FBCMB)	D216	27	19	3,180	2,380	4,516	3,380	2,500	2,500	7,016	5,880
SUBTOTAL PERSO	NNEL & USF	536	367	58,160	40,680	82,587	57,766	156,639	156,889	239,226	214,654
SUMMARY D3 (Core Resource Unit)											
				NET	AREA	TOTA	LAREA				
OFFICE / BRANCH	CODE	PERS	ONNEL	PERS	ONNEL	PERS	ONNEL	SUPPORT	AREA (SF)	TOTAL A	AREA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
	D2	22	10	2 200	2 560	4 672	2 625	1 699	1 699	6 250	E 222
	D301	63	10	6,620	2,300	9,400	6 731	1,000	1,000	11 275	8,606
Computation Aerodynamics	D301	26	40	5 200	2 2 2 2 0	7 2 9 4	4 714	2,010	2,010	10.204	7,624
	D302	21	22	3,200	3,320	1,304	4,714	2,910	2,910	22 552	22 122
Adv Seneera & Optical Macaurament	D303	62	42	6.200	2,200	4,029	6 101	10.044	10.044	10 102	16 225
	D304	42	42	0,360	4,300	9,000	0,191	2 750	10,044	10,103	0 407
	D305	40	24	3,760	2,560	5 330	3,635	5,750	4,000 500	5 830	4 135
	D300	50	24	5,700	2,300	7,669	5,000	975	975	0,009	4,133
Struct Acoustics	D310	30	16	2,200	1,690	2 200	0,202	16.645	16 645	0,040	10.021
	D314	25	10	2,300	2,540	5,360	2,300	12,045	12 226	19 527	16,001
Adv Materiala & Brossnaing	D314	70	23	7 160	2,540	10 167	3,007	24 426	24 426	10,007	10,000
Adviviatemais & Processing	D307	70	40	7,100	4,960	710	7,043	34,420	34,420	44,595	41,409
Active as a comp Mathada	D300	32	22	500	300	6 700	420	750	750	1,400	1,170
Analytical & Comp Methods	D309	4/	31	4,780	3,200	0,700	4,029	5,500	6,750	12,200	50,000
	D311	59	40	0,000	4,100	0,005	5,907	44,313	44,313	22,918	20,220
Structural Dynamics	D311	41	28	4,260	2,960	6,049	4,203	26,750	26,750	32,799	30,953
Needestructive Evolution Original	D312	51	3/	5,660	4,100	8,037	5,822	50,254	51,154	58,291	56,976
	D313	51	3/	5,420	4,020	7,696	5,708	31,833	31,833	39,529	37,541
	D315	69	53	7,300	5,620	10,366	7,980	/50	/50	11,116	8,730
	D316	43	31	4,620	3,420	6,560	4,856	10,178	10,178	16,738	15,034
Vehicle Dynamics	D317	29	20	4,340	2,960	6,163	4,203	11,969	12,906	18,132	17,109
(inour Eluctorea () a craticana	1 0240	1 76	56	1 8 960	1 6 6 4 0	12723	1 9429	6 5 1 1	1 6648	1023/	16076

with other groups, security and visitor needs/accessibility, and future requirements was also obtained using this survey. Subsequent staff interviews and site visits further supplemented and informed this survey data. (An example of the Questionnaire can be found in Appendix 1 – Housing Master Plan.)

Survey Findings and Observations The results of the office questionnaire pointed to several issues, largely systemic in nature, and dealing particularly with the condition of work areas and the existing building stock.

This irregular pattern of growth has also contributed to the separation of laboratories from their associated offices, often with the former being in an entirely different building from the latter. Additionally, there is a general lack of open, collaborative work areas where the interchange of ideas can occur in an informal way. Conference rooms and training rooms tend to be allocated on a per group basis rather than shared and centralized; and copy rooms and pantries in most cases have not been planned as separate areas. This problem can be found with regard to most storage rooms as well - with laboratory and/or office supplies located in inadequate, illplaced storage facilities.

The inadequacies apparent in the existing work areas only underscores the fact that most buildings on the LaRC campus cannot provide stateof-the-art working environments for laboratories, offices or support areas. Due to the aging architectural, structural or engineering systems found in the existing housing stock, these buildings lack the flexibility required for the Center to use them efficiently without major capital investment. Finally, the condition of these existing buildings does not necessarily provide the good first impression sought by either the Langley Research Center or NASA.

In regards to the work areas, it was found that most LaRC offices do not adhere to the size standards recently mandated by NASA because they are located in older buildings that were designed to other standards. These new space guidelines call for an allocation of office space to be 125 square feet per person. In cases where an existing office is too large, it is often shared by two people, resulting in less space per person than outlined by the NASA guidelines. These space inadequacies are compounded by the misappropriation of work areas for functions in which they were not originally designed. For example, in some instances traditional office space has been modified to accommodate laboratory uses.

SUMMARY D3 continued											
Sensors Research	D319	22	18	2,440	2,040	3,465	2,897	16,313	16,313	19,777	19,209
Reliable Digital Systems	D320	54	38	5,560	3,960	7,895	5,623	11,138	11,138	19,033	16,761
SUBTOTAL PERSO	NNEL & USF	1,047	734	111,550	79,300	158,401	112,606	331,119	334,593	489,520	447,199
SUMMARY D4 (Core Resource Unit)				_				_			
UNIT / OFFICE	CODE	PERS	ONNEL	NET PERS(AREA ONNEL	TOTAL PERSC	AREA NNEL	SUPPORT	AREA (SF)	TOTAL AI	REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
CENTER OPERATIONS DIRECTORATE											
Directors Office	D4	222	148	24,110	16,630	34,236	23,615	78,543	52,518	112,779	76,132
ROME On-Site Contractors	D4	240	182	25,200	19,000	35,784	26,980	0	0	35,784	26,980
Logistics On-site Contractors	D4	50	38	4,380	3,020	6,220	4,288	0	0	6,220	4,288
Environmental On-site Contractors	D4	10	9	1,160	1,060	1,647	1,647	0	0	1,647	1,647
Security On-site Contractors	D4	62	61	2,520	2,520	3,578	3,578	0	0	3,578	3,578
Survey/Inspection On-site Contractors	D4	15	14	1,580	1,480	2,244	2,102	0	0	2,244	2,102
Grounds/Custodial On-site Contractors	D4	75	58	1,160	760	1,647	1,079	0	0	1,647	1,079
SUBTOTAL PERSO	ONNEL & USF	674	510	60,110	44,470	85,356	63,289	78,543	52,518	163,899	115,807
SUMMARY E1-E4											
UNIT / OFFICE	CODE	PERS	ONNEL	NET PERSO	AREA ONNEL	TOTAL PERSC	AREA DNNEL	SUPPORT	AREA (SF)	TOTAL AI	REA (SF)
		2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
BUSINESS OR PRODUCT UNIT						,				·,	
Aeronautic Research Directorate	E1	59	41	6,810	4,860	9,670	6,901	5,438	3,938	15,108	10,839
ESSO	E2	76	54	8,940	6,500	12,695	9,230	2,375	2,375	15,070	11,605
Science Directorate	E3	357	271	37,360	28,600	53,051	40,612	22,685	27,685	75,736	68,297
Systems Analysis and Concepts Directorate	E4	198	144	20,980	15,260	29,792	21,669	7,313	7,313	37,104	28,982
SUBTOTAL PERSC	NNEL & USF	690	510	74,090	55,220	105,208	78,412	37,810	41,310	143,018	119,722
SUMMARY G1											
UNIT / OFFICE		PERSONNEL		NET AREA PERSONNEL		TOTAL AREA PERSONNEL		SUPPORT AREA (SF)		TOTAL AREA (SF)	
	CODE	. 2.10		PERSO	ONNEL	PERSC	DININEL		, , ,		
	CODE	2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
PROJECT UNIT	CODE	2005	2020	2005	2020	2005	2020	2005	2020	2005	2020
PROJECT UNIT Flight Project Office	CODE G1	2005 41	2020 28	2005 6,720	2020 4,700	9,542	2020 6,674	2005 2,813	2020 3,063	2005 12,355	2020 9,737
PROJECT UNIT Flight Project Office SUBTOTAL PERSO	G1	2005 41 41	2020 28 28	PERS(2005 6,720 6,720	2020 4,700 4,700	9,542 9,542	6,674 6,674	2005 2,813 2,813	2020 3,063 3,063	2005 12,355 12,355	2020 9,737 9,737
PROJECT UNIT Flight Project Office SUBTOTAL PERSO SUMMARY H1	G1	2005 41 41	2020 28 28	6,720	2020 4,700 4,700	9,542 9,542	6,674 6,674	2005 2,813 2,813	2020 3,063 3,063	2005 12,355 12,355	2020 9,737 9,737
PROJECT UNIT Flight Project Office SUBTOTAL PERSC SUMMARY H1 UNIT / OFFICE	G1 NNEL & USF	2005 41 41 PERS0	2020 28 28 28 DNNEL	PERS0 2005 6,720 6,720 NET PERS0	2020 4,700 4,700 AREA ONNEL	9,542 9,542 9,542 TOTAL PERSC	6,674 6,674 6,674 AREA DNNEL	2005 2,813 2,813 SUPPORT	2020 3,063 3,063 AREA (SF)	2005 12,355 12,355 TOTAL AI	2020 9,737 9,737 REA (SF)
PROJECT UNIT Flight Project Office SUBTOTAL PERSC SUMMARY H1 UNIT / OFFICE	G1 ONNEL & USF CODE	2005 41 41 PERS 2005	2020 28 28 28 ONNEL 2020	PERS(2005 6,720 6,720 NET PERS(2005	2020 4,700 4,700 AREA ONNEL 2020	9,542 9,542 9,542 TOTAL PERSC 2005	6,674 6,674 6,674 AREA NNEL 2020	2005 2,813 2,813 SUPPORT 2005	2020 3,063 3,063 AREA (SF) 2020	2005 12,355 12,355 TOTAL AI 2005	2020 9,737 9,737 REA (SF) 2020
PROJECT UNIT Flight Project Office SUBTOTAL PERSC SUMMARY H1 UNIT / OFFICE INNOVATION INSTITUTE	G1 INNEL & USF CODE	2005 41 41 PERS 2005	2020 28 28 28 2NNEL 2020	PERS0 2005 6,720 6,720 NET PERS0 2005	2020 4,700 4,700 AREA ONNEL 2020	9,542 9,542 9,542 TOTAL PERSC 2005	2020 6,674 6,674 0,674 2020	2005 2,813 2,813 SUPPORT 2005	2020 3,063 3,063 AREA (SF) 2020	2005 12,355 12,355 TOTAL AI 2005	2020 9,737 9,737 REA (SF) 2020
PROJECT UNIT Flight Project Office SUBTOTAL PERSC SUMMARY H1 UNIT / OFFICE INNOVATION INSTITUTE Innovation Institute	G1 NNEL & USF CODE H1	2005 41 41 PERS 2005 15	2020 28 28 28 DNNEL 2020	PERS0 2005 6,720 6,720 NET PERS0 2005 1,800	2020 4,700 4,700 AREA DNNEL 2020 1,300	9,542 9,542 9,542 TOTAL PERSC 2005 2,556	2020 6,674 6,674 .AREA NNEL 2020 1,846	2005 2,813 2,813 SUPPORT 2005 10,625	2020 3,063 3,063 AREA (SF) 2020 10,625	2005 12,355 12,355 TOTAL AI 2005 13,181	2020 9,737 9,737 REA (SF) 2020 12,471

NASA LaRC Space Utilization Criteria

IED A DALY

The new space guideline, of 125 square feet (SF) per person, was created by NASA in order to achieve a uniform distribution of available office space while maximizing the cost-effective use of space in the Center's existing buildings. However, the implementation of this space utilization guideline in existing buildings has been problematic due to existing irregular configurations and floor plans. Therefore, revised space guidelines specific to this project were developed, that would still achieve the 125 SF average while providing greater flexibility in its application.

Three standard office sizes were developed, ranging is size from 100 SF to 250 SF, as outlined in the adjacent chart.

TYPE OF OFFICE SPACE	ABBREVIATION	AREA
Enclosed Office 1	ENC 1	250 SF
Enclosed Office 2	ENC 2	180 SF
Open (or semi-enclosed) Office	0	100 SF

Support areas (primarily conference and training rooms) were calculated using standard sizes based on the number of persons to be seated in each area. This framework was used consistently throughout the tabulations for the various Directorates and Offices. Since pantries and copying-fax rooms are considered common support areas within a building, these spaces were taken into consideration as part of a building's common area and not as part of an individual group's area. Below is a chart showing the standard sizes utilized for these common support areas.

OFFICE SUPPORT AREAS	TYPE	AREA
10-12 Person Conference Room	Enclosed	350 SF
15 Person Conference Room	Enclosed	450 SF
20 Person Conference Room	Enclosed	600 SF
25 Person Conference Room	Enclosed	700 SF
30 Person Conference Room	Enclosed	750 SF
50 Person Conference Room	Enclosed	1000 SF
Pantry	Enclosed/Open	150 SF
Copy Room	Enclosed	150 SF

Laboratory space for each area was determined using information gathered as part of the group questionnaires. However, information and tabulation of wind tunnels were intentionally omitted because their unique infrastructure requirements make it unlikely that they will be relocated or replaced in the New Town project.

Space considerations for common facilities such as a Cafeteria, Fitness Center, Day Care Center, and Credit Union are also addressed; since these facilities are an integral part of the Center and provide a sense of community and township.

Program Findings and Conclusions

Through the data gathering process, the programming team was able to observe the current working conditions at the Langley Research Center; and through its analysis, provide insight into future space requirements reflected in New Town. These observations: fall into three general areas: population, space requirements, and New Town buildings. Based on projections provided by NASA the population at Langley Research Center will decline in the next five years between 2005 and 2010. This will include an estimated 33% reduction in the amount of civil servants and a nearly

20% reduction in contract personnel. This results in a net staff reduction of approximately 25% to 28% for the entire Center. Once these reductions have taken place, the population is expected to remain relatively unchanged over the next decade between 2010 and 2020. This declining population trend is reflected in the personnel numbers for each Unit or Directorate in the program document and for the Langley Research Center overall, which will experience a decline in population from 4,063 to 2,917 between 2005 and 2010. However, the Headquarters components of The Independent Program Assessment, The Office of the Inspector General and the NASA Engineering & Safety Center are not expected to experience a decrease in staffing levels. (See adjacent charts for Projected Population Trends and Total Personnel and Area Summary.)

Unlike the personnel reductions, the space requirements are based on current allocations. The tabulations for the area requirements are based on the program space utilization criteria and not on existing areas or buildings. This criterion assumes an efficient use of space that can be applied to new or renovated buildings. The total area required to house staff and support spaces in 2005 is nearly 1,487,608 SF, while between 2010 and 2020 it will be reduced to approximately 1,142,310 SF. This represents a saving of roughly 345,000 SF of space. However, this does not reflect reductions to support areas, which for the most part have not been factored into the final program document. Future analysis of each support space should be done to further improve the total area reduction.

Both the personnel and space requirements outlined above are instrumental to the design of New Town. In particular, the size of the proposed New Town buildings is based on the anticipated program population and area calculations for the year 2020. These new buildings are broken into three types: administrative office buildings, laboratories, and a shared facility. The New Town administrative office buildings are





TOTAL PERSONNEL AND AREA SUMMARY							_				
UNIT / OFFICE		PERSONNEL		NET AREA PERSONNEL		TOTAL AREA PERSONNEL		SUPPORT AREA (SF)		TOTAL AREA (SF)	
	2005	2020	2005	2020	2005	2020	2005	2020	2005	2020	
A CORPORATE UNIT							-				
SUBTOTAL PERSONNEL & USF	12	8	2,110	1,550	2,996	2,201	2,375	2,375	5,371	4,576	
A1-AH HEADQUARTER FUNCTION UNIT											
SUBTOTAL PERSONNEL & USF	50	49	7,560	6,830	10,735	9,699	7,094	3,931	17,829	13,630	
OFFICE OF INSPECTOR GENERAL					-			-			
SUBTOTAL PERSONNEL & USF	12	12	2,160	2,160	3,067	3,067	0	0	3,067	3,067	
B1-B7 SHARED SERVICES UNIT											
SUBTOTAL PERSONNEL & USF	666	444	77,540	52,950	110,107	75,189	218,678	79,589	328,784	154,778	
C1-C4 STRATEGIC MANAGEMENT UNIT							-				
SUBTOTAL PERSONNEL & USF	149	119	17,440	14,140	24,765	20,079	18,670	5,625	43,435	25,704	
D1 FLIGHT RESEARCH SERVICES DIRECTORATE											
SUBTOTAL PERSONNEL & USF	171	126	18,520	13,620	26,298	19,340	1,625	1,625	27,923	20,965	
D2 SYSTEM ENGINEERING DIRECTORATE											
SUBTOTAL PERSONNEL & USF	536	367	58,160	40,680	82,587	57,766	156,639	156,889	239,226	214,654	
D3 RESEARCH & TECHNOLOGY DIRECTORATE											
SUBTOTAL PERSONNEL & USF	1,047	734	111,550	79,300	158,401	112,606	331,119	334,593	489,520	447,199	
D4 CENTER OPERATIONS DIRECTORATE											
SUBTOTAL PERSONNEL & USF	674	510	60,110	44,470	85,356	63,289	78,543	52,518	163,899	115,807	
E1-E4 BUSINESS OR PRODUCT UNIT											
SUBTOTAL PERSONNEL & USF	690	510	74,090	55,220	105,208	78,412	37,810	41,310	143,018	119,722	
G1 PROJECT UNIT					-			-			
SUBTOTAL PERSONNEL & USF	41	28	6,720	4,700	9,542	6,674	2,813	3,063	12,355	9,737	
H1 INNOVATION INSTITUTE					-			-			
SUBTOTAL PERSONNEL & USF	15	10	1,800	1,300	2,556	1,846	10,625	10,625	13,181	12,471	
TOTAL PERSONNEL & USF	4,063	2,917	437,760	316,920	621,619	450,168	865,989	692,141	1,487,608	1,142,310	

Chart for the Projected Population Decline

planned to house the Corporate Unit: A, Headquarters Units: A1-AH and OIG, Shared Services Units: B1-B7 and Strategic Management Units: C1-C4. The support areas for these Units have been modified in the program calculations to reflect the New Town planning. The New Town laboratories were planned according to the results of the Design Workshop for New Town Laboratories at LaRC. The Laboratory buildings will be focused on the following areas of research: Sensors and Instrumentation Development, Laser Development, and Material Evaluation and NDE Testing. A new common support building will house training facilities, a conference center, the LaRC cafeteria and other shared services.





BUILDING	DESCRIPTION
1148	Structures and Materials Research Laboratory
1149	Office of Inspector General and Occupational Medical Center
1151	Space Sciences Support
1152	Media Services Center
1153	EOP/External Affairs
1195	Institutional and Program Resources
1200	Measurement Science Research Laboratory
1202	Aerodyner & Pearl Young Conference Center
1205	Materials Research Lab, Light Alloy Lab
1208	Acoustics Research Laboratory, Blower House, Aero Acoustics Branch, Clerical and Administrative Support Team
1209	Facility and Systems Engineering
1213	West Area Cafeteria, NASA Exchange Shop and PSCN
1218/1218A	Conference Center and Anechoic Noise Facility
1219	Langley Research Center Headquarters
1220	Airborne Systems and Electromagnetic Research Facility
1222B	NASA Gymnasium/Fitness Center
1225	Advanced Machining Development Laboratory & Model Systems Fabrication
1229	Technology Application and Structures, Locksmith Shop and Metal Cleaning
1232/1232A	Aerospace Systems Concepts & Analysis, and Metals Technology Development Lab
1267	Thermal Structures Laboratory
1268	Central Scientific Computing Facility
1293	Polymeric Materials Offices & Labs, Structural Dynamics Research
1298	Hyper X Program Offices
1299	Flight Electronics & Electromagnetic Lab

NO. OF BUILDINGS	AGE (YEARS)	SPACE (GSF)
1	18	18,726
9	28 – 40	456,095
3	41 – 50	207,167
7	51 – 60	306,111
4	63 – 64	101,415
TOTAL = 24	AVG. AGE = 47	TOTAL = 1,089,514

renovated.



Facilities Evaluation Survey

During the week of December 6 - 10, 2004, two teams of architects and engineers from LEO A DALY surveyed 24 buildings and the infrastructure at Langley Research Center (LaRC). The representative sampling of buildings were chosen for evaluation based on the previous business case analysis, Facilities Plan: Needs Assessment and Investment Options, in June 4, 2004.

The goal of the facilities survey was two-fold:

- 1. Evaluate the overall conditions and the estimated renovation costs to upgrade the facilities.
- 2. Determine the flexibility of the buildings for potential reconfiguration.

If a building was found to be "flexible" this means it is a potential candidate for complete renovation, because it could support a variety of layout configurations that could change to match the mission. Existing architectural features that cannot be readily changed, such as the floor-toceiling height, the location of load-bearing walls, and the dimensions of the basic floorplate, were used to determine a building's flexibility.

The buildings that were chosen to be surveyed were those that met two or more of the following business case evaluation criteria:

FCI < 4.3: A Facility Condition Index (FCI) score of less than 4.3 indicates that a building has the potential for systems failure, thereby impacting missions and programs. The lower the FCI, the worse the building condition.

INV/CRV < 10%: If the level of the Investment (INV) in the building over the past 10 years, compared to its Current Replacement Value (CRV) is less than 10%, then it is assumed that no significant investment has been made in the building to keep it up to date.

DM/CRV > 5%: If the Deferred Maintenance (DM) on the building, as compared to its Current Replacement Value (CRV) is greater than 5%, then it is assumed that the maintenance on the building has not kept up with the need and the building is continuing to deteriorate.

Scheduled Demolition or Vacated: If a building is vacant or funded for demolition, it is assumed that it is no longer needed to support NASA's program.

From the Facilities Plan: Needs Assessment and Investment Options report dated June 4, 2004, over 1.2 million square feet of facilities met this criteria. Of this group, a representative sample was selected for surveying, with the intent that the results could then be extrapolated over the entire building inventory.



Building 1219 was Determined a Good Candidate for Renovation

FACILITIES EVALUATION SUMMARY

The following buildings were evaluated:

The age of the surveyed buildings can be grouped as follows:

The site and infrastructure systems which were surveyed included the streets, stormwater drainage, sanitary sewers, potable water, steam and steam tunnels, telecommunications, and electrical power. They were surveyed to assess their adaptability to serve future sites for new buildings, as well as continuing to serve the existing buildings that may be





...continuation of the **Facilities Evaluation Summary**

Findings

Buildings

The survey revealed that the majority of all architectural deficiencies in the buildings generally fall within three areas: roofs, facades, and interiors. Roof repairs account for approximately 48% of all anticipated architectural deficiencies, while facades and interiors accounted for 28% and 24%, respectively. Only three (3) buildings sampled require minor foundation or other structural repairs.

The HVAC systems in most buildings need either major upgrades or replacement as part of a complete building rehabilitation. Repairs or replacement of the HVAC system account for 70% of all mechanical deficiencies, followed by 20% for the plumbing and 10% for the fire protection systems.

The electrical systems in the surveyed buildings generally need upgrades in the following areas: circuit panelboards, switchgear, motor control centers, conduit and raceways, emergency lighting, surge suppressors, light fixtures, and receptacles.

Of the buildings surveyed, seven (7) were determined to be inflexible for adaptive reuse, and should therefore be considered candidates for demolition: 1149, 1151, 1152, 1153, 1213, 1218/1218A, and 1220.

Site Infrastructure

The streets are generally in good condition and provide adequate access to the "New Town" development. There are some areas that should be replaced with new paving. It was estimated that approximately 10% of the asphalt pavement and 5% of the concrete pavement should be replaced.

The stormwater drainage system is generally in good condition. There are approximately 40% of the headwall structures that are deteriorated and 20% of the piping that should be replaced.

The potable water system is in good condition, with only a few older lines that should be replaced.

The sanitary sewage system is in need of some major improvements. The Center is already in the process of replacing the main lift station. However, the network of pipes and manholes are very old and experiencing a significant amount of inflow and infiltration from stormwater runoff, groundwater, and possibly stormwater connections. As soon as the results of the ongoing Infiltration & Inflow study are available, a program for the replacement of leaky pipes and manholes should be implemented. It is estimated that approximately 90% (36,600 LF) of the sewer lines will

need to be replaced, as well as 90% of the manholes.

The 1940s vintage utility tunnels are plagued with water infiltration through cracked walls and unsealed pipe penetrations. This has caused the corrosion of all exposed steel, such as pipe supports, and leaves standing water. The tunnels are also overcrowded in some areas where recent utilities, such as fiber optic cables and potable water pipes, have been added which exceeds the original design spacing. The leaks in the existing tunnels need to be repaired and additional tunnel capacity provided through expanded tunnels or new parallel tunnels.

The steam piping system needs to catch up on routine maintenance and repairs, such as adding more steam traps, replacing pipe insulation, replacing old valves, relocating steam condensate vents, and nondestructive testing of pipe wall thicknesses. For future reliability and capacity, the leaking underground direct-bury piping should be replaced, preferably in tunnels and additional piping loops constructed. Also new larger capacity double-walled heat exchangers should be installed in the central plant.

There is sufficient electrical power available and adequate redundancy in both incoming service and distribution systems. In order to plan for future expansion and make the existing infrastructure more efficient, a careful study needs to be done for improving the system and preventing oversizing of replacement equipment.

Estimated Costs

Estimating costs for the short-term immediate repairs noted above.



A steam tunnel at LaRC illustrates the leaks and overcrowding prevalent throughout its utility tunnel system

without the benefit of design, and extrapolating the data to buildings and infrastructure not surveyed, requires the use of significant contingencies, and the presentation of costs in ranges. The costs anticipated for both short-term and long-term upgrades are presented in the chart below:

BUILDING RENOVATIONS	RANGE OF COSTS / GSF
Short-Term Repairs ¹	\$10 - 45
Long-Term Improvements ²	
Exterior Facade Modernization	\$20 - 30
ADA Compliance	\$10 - 20
New Interior Finishes	\$40 - 50
New Lighting	\$10 - 15
HAZMAT Remediation	\$10 - 20
ESTIMATED TOTAL	\$100 - 180

¹ Deficiencies observed in the building and building systems which needed immediate repair in order to maintain operations.
² Upgrades or improvements that would be required in order to raise the overall building quality for continued long-term use

Conclusion

The facilities survey confirmed the costing assumptions made in the Facilities Plan: Needs Assessment and Investment Options report dated June 4, 2004, that a renovation cost of \$114/GSF (construction), was within the likely range of repairs and improvements needed to renovate Langley's administrative facilities deemed suitable for adaptive reuse. This cost also validated the Econpack Financial Model input used in the early study which yielded a reasonable Savings-to-Investment Ratio and Discount Payback Period for New Town; and is used as the basis for further modeling in this Strategic Concept Plan.

The buildings selected for renovation in this Strategic Concept Plan were taken from the pool of facilities deemed flexible for adaptive reuse, and support the programming and master plan requirements of the other sections of this study.

The existing site and utilities infrastructure appears to have adequate capacity to serve the infill type development envisioned for "New Town" within the Core Concept, considering the demands removed through building demolitions versus the needs of newly constructed buildings. However, routine upkeep and maintenance work must continue, along with a planned effort to upgrade and modernize the basic infrastructure systems throughout the campus.

Not included in the building renovation costs are the funds associated with site and infrastructure improvements. The site and utility infrastructure will require between \$15 to \$25 million to correct existing deficiencies and an additional \$10 to \$15 million to expand and serve "New Town."



Introduction

A key component of the **Strategic Concept Plan** is the Master Plan. The Master Plan provides the development framework for all proposed renovation, new construction, and demolition envisioned as a part of 'New Town', while accommodating future opportunities for growth/expansion around the campus. It draws information of the existing building stock from the Facilities Evaluation; and utilizes the current and future space requirements identified in the Housing Master Plan for development density. The economic viability of the Master Plan is tested through the Econpack model in the *Cost/Benefit Analysis*, and phased to provide greater flexibility with *Alternative Funding Strategies*. Overall, the *Master Plan* provides a positive direction for Langley to move in its 'repair-by-replacement' program, while achieving its goals for future development.

NASA Langley Research Center is currently defined by its aging building stock, sprawling pattern of development, and expansive campus. At a time when its research facilities need to be updated or replaced to respond to new missions, it is struggling to fund even modest upgrades to keep its facilities operational. Given planned staff reductions, this is an ideal time to consolidate the campus into a smaller, 'more manageable' core; but any consolidation requires investment, and funding for capital projects has been extremely limited.

This *Master Plan* looks at the current organization of Langley's facilities, and provides an approach for future development that places all proposed new construction and renovation within a defined core area of the campus. It also looks at four potential locations for the core area, and recommends an area that is central to the majority of facilities and services of the Center. Finally, it recommends a phased program of new construction

MASTER PLAN

Evolution of New Town as a Core Concept



New Town as a Core Concept

According to the Housing Master Plan, the overall staff for Langley is to decrease by approximately 25% over the next five years, and then remain steady till the year 2020. Reduced staff requires less building area, providing Langley an opportunity to demolish some of the worst of its building stock around the campus (as identified in the most recent Facility Assessment). By focusing this demolition on those worst facilities in the 'Back 40' and in other 'outreaching' areas, and clearing other strategic areas for future development, the Center can begin to consolidate its operations within a smaller core area that would be easier to maintain and more efficient to operate. A smaller campus area means less utility infrastructure to maintain; and makes it easier for the reduced staff to navigate between buildings by walking rather than driving.

Placement of the core is critical to the success of New Town. This Master Plan study looked at four potential locations, or options, for placing the core within the existing campus. (See exhibit 'Evolution of New Town As A Core Concept'.)

- problematic.
- Force Base (AFB).

Option 4, focusing future development within the older central core of the campus, was selected by Langley as the best alternative for New Town. The area already supports a mix of laboratory research, administrative, and support functions; and is fully serviced by the existing site utility infrastructure. Although the area is already built-out, several of the older buildings are in poor condition, and need to be demolished. Their removal will provide opportunity for new construction that can focus on Langley's future.

and renovation within the core, offset by extensive demolition throughout the campus, as a means to implement the development economically.

1. Option 1 is the area previously identified for New Town, near the current conference center and recreation areas. This area is relatively clear; but has experienced some flooding. Recently, archeological remains have been discovered on the site, making future development there

2. Option 2 is located closer to Langley's secondary entrance, expanding the campus development area outward toward the forested wetlands.

3. Option 3 includes the major wind tunnel area along the perimeter of the site, adjacent to North Armistead Avenue near the main entrance to the Center. It also includes the hanger area adjacent to Langley Air

4. Option 4 is primarily the older part of the campus, defined by an existing loop road created by Langley Boulevard and Taylor Street.

In further study, the proposed core (See exhibit ' Map of New Town Core and Proposed Zones') was expanded from the initial inner loop area to the full area around the loop road, recognizing that the functional areas on both sides of the loop road are critical to the Center's primary activities. This expanded core area includes the main entrance to the Center, and will be the first area visitors see when they come to Langley. As such, New Town provides a great opportunity to re-establish Langley's image as a 'state-of-the-art' Center of Excellence for NASA.

Surrounding Zones

Around the proposed core are four other areas, including:

- □ Back 40
- □ Long-Term Expansion
- Industrial Facilities Area
- □ No Build

The Back 40 represents the most remote area of the campus, at the northern tip of the site where it meets the Chesapeake Bay. The Center has been gradually pulling back from this area, in part because of the high cost to maintain the facilities and utility infrastructure. The intent of this master plan is to abandon the remainder of the area as its facilities become no-longer needed. This area is directly adjacent to, and accessible from, Langley AFB.

The Long-Term Expansion area already supports much of the Center's research activities, with additional land available for further development. However, many of the facilities within this area are potential demolition opportunities, which would further reduce the density. Rather than invest the new construction or renovation in this area, all new development will be accommodated within the proposed core. This area, with its proximity to the secondary entrance, provides a prime opportunity for utilizing private sector investment; and the land can also provide a reserve of space for future 'undefined' NASA activities.

The Industrial Facilities Area houses the basic operational functions of Langley including storage, fabrication, shipping, and outdoor storage. These facilities all have a strong industrial character, and should remain active to support the Center's operations.

The No Build area is adjacent to the hanger area near Langley AFB. Construction in this location is limited due to its proximity to the active flight lines. This area serves as a modest buffer between NASA and the air force base.

Map of New Town Core and Proposed Zones



Circulation, Access & Parking Strategies

Beyond the new security building at the Main Gate, the entrance boulevard defines the arrival sequence into LaRC, and forms the southern edge of the New Town Core. The New Town Core is generally circumscribed by Langley Boulevard and Taylor Street, and defines the pedestrian zone within the core. Through-traffic will be able to travel unimpeded around the core as it exists currently along Langley Boulevard and Taylor Street. The existing East Durand, West Reid, and Walcott streets will be closed to traffic between Langley Boulevard and Taylor Street.



Working within the existing infrastructure and road network, the inner Core area is a planned pedestrian zone. With the exception of parking and loading access, local roads within the inner Core will have limited access in order to encourage a pedestrian-friendly environment.

Parking for New Town Core buildings will be provided both within and outside the Core "ring-road" utilizing many of the existing parking lots. Where new buildings replace existing parking lots, the plan will accommodate for parking on-site or in adjacent locations. Typically these are a combination of reconfigured old, and new parking lots. Consolidated parking is usually more efficient, however some lots have odd configurations making parking relatively inefficient. In order to utilize these inefficient areas, green islands can be introduced within the lots, leaving mostly rectangular (most efficient) areas for the cars to park. The green islands can be landscaped, slightly elevated areas high enough to obstruct views across the parking lot. It will help to avoid any perception of vast areas dedicated to parking.

Map of Road Closures in New Town

^{...} continuation of the Master Plan

Program Requirements and the Core

The Housing Master Plan Summary outlined program requirements for LaRC now and in the future. Required new construction would be concentrated in the Core area and consist of three main building types: Office Space for administrative headquarters units; Laboratory Space for Sensor/Instrumentation, Laser and Material Evaluation/NDE; and a Shared Use Facility that would house both a new conference center and the campus' cafeteria. A breakdown of new construction for New Town is as follows:

FACILITY TYPE	NO. OF BUILDINGS	GROSS SQUARE FEET
Shared Use Facility	1	50,000
Conference Center		28,000
Cafeteria		18,000
Printing Services (Optional)		4,000
Office Space	2	215,000
Laboratory Space	3	129,000
Sensor/Instrument Lab		55,470
Laser Lab		33,540
Material Evaluation/NDE Lab		39,990

In addition to new construction, New Town also includes significant renovation and demolition, which will be discussed further in the Phasing section.

Key Design Concepts for the Core

The final design strategy for the Core was derived from four key design concepts. These concepts, outlined below, allowed the team to shape the design without losing focus of the over-arching goals of the master plan, ultimately having a fundamental impact on the final plan.

1. Re-enforce the Pedestrian Spine: The Core already has an existing



Current Pedestrian Spine

pedestrian spine, however, due to a disjointed pattern of development this potential asset is currently unrealized. Through selective demolition and the concentration of new facilities in the Core, this pedestrian corridor can be reinforced and further enhanced. Suggested improvements to the pedestrian spine include the extension of the north-south corridor south to Langley Boulevard; closing West Reid Street and reconfiguring the area into a secondary pedestrian spine. Since West Reid Street is perpendicular to and bisects the existing pedestrian corridor, this secondary pedestrian spine would allow for easy east-west movement within the New Town Core area. Additionally, this east-west connection would compliment the existing north-south circulation pattern. In order to create a pedestrian friendly environment, large areas of greenery would flank both pedestrian spines. This along with the interspersion of "pocket parks" adjacent to the spines throughout the core will further enhance the campuslike quality of the Core. The cross-streets of West Durand and West Walcott will need to be closed between Langley Boulevard and Taylor Street thus eliminating all vehicular traffic from the Core's pedestrian area.

- 2. Create Formalized Open Spaces: Currently there is little formal open space within the Core. In order to create a campus-like atmosphere in the Core, in addition to the pedestrian spines, new formalized outdoor



Existing Formal Space Along Pedestrian Spine

open spaces are imperative. The creation of two major plazas along the main pedestrian spine will achieve this goal. The first, a "civic" plaza would be located in the center of the Core, at the intersection of the two pedestrian spines. This will serve as the main outdoor civic plaza and will be located directly adjacent the new Shared Facilities Building. The second, "ceremonial" plaza would be located in the area between Langley Boulevard and former West Walcott and West Durand streets. Because of its location at the entrance to the Core, it would be more ceremonial in nature. Additionally, the possibility of the new Headquarters building being located in this area would further elevate the plaza's prominence as the ceremonial heart of Langley's New Town.



Red Brick Buildings Dominate LaRC's Core Area



Windtunnels and Spheres Help Define LaRC's Current Design Vocabulary

3. Repair-by-Replacement: The majority of buildings in the Core were built before 1955 and are in varying degrees of disrepair. By locating "New Town" in the historic core of LaRC's campus, NASA can best achieve its' goal of "repair by replacement." Buildings that are structurally unsound or no longer meet the mission needs of LaRC can be removed in order to make way for the Center's future. These new buildings will help to shape the Center's new identity as it repositions itself in the 21st Century — by both embodying the future needs and goals of LaRC as well as respecting the existing buildings and landscape. Repair by replacement will allow LaRC to selectively replace its' most outdated buildings and those in need of significant renovation with new state-of-the-art facilities; thus eliminating its' liabilities while as the same time gaining valuable assets.

4. Contextual Design: LaRC has 90 years history and established image. The Core over the years has been known by several names, one of which was the Red Brick area, denoting the red brick character of the buildings in this area. Maintaining this traditional use of materials as well as preserving the horizontal scale of the campus are fundamental to creating a contextual design for Langley. To achieve this, the overall design approach for new buildings will follow a contemporary, modern aesthetic while containing features consistent with the existing buildings.

These updated designs will use a similar design vocabulary to their historical counterparts, achieved contextually through materials and scale. These new buildings will be primarily clad in glass to maximize the use of natural light. White metal or red brick panels will be used to accent these glass structures creating continuity within the Core. The white metal panels will echo the white in existing structures such as vacuum spheres and windtunnels; whereas the use of red brick would pay homage to the historical development of the Center's Red Brick area. This approach will allow the creation of new buildings in the Core whose size and design compliment the existing campus while providing a modern interpretation in terms of the "overall look" and building systems.

Landscaping at the Langley Research Center will also be a consideration since it is such a dominant feature of the campus. Preservation of existing trees and shrubbery will be a priority; in particular large caliber trees will be given special consideration.

Design of New Buildings in the Core

Laboratory and Office Buildings

The majority of new construction proposed for New Town will be dedicated to laboratories and administrative offices, and located within the core. As such, their design, including shape, size, and orientation will be the defining aspects for the core. Most existing laboratories and offices are rectangular buildings. However, in order to accommodate random relations of new building with adjacent elements such as streets, pedestrian walkways, trees, parking lots, and other buildings, each new building will be chamfered at one edge. This chamferring will optimize the integration of new buildings into the existing core, and facilitate the creation of inviting vistas within and outside the Core. For optimal efficiency, laboratory buildings should be no more than two stories; while four stories is recommended for the administrative offices. Differing levels of transparency should be explored for the facades of all buildings since the exposure from the sun will vary according to location and orientation.

The shape of a building is directly influenced by its size requirements, particularly its minimum floor plate size. The suggested building floor plate width for both office and laboratory buildings is approximately 90-feet. This is considered a reasonable floor width for sustainable design in optimizing daylight into the interior spaces.



View of the New North-South Pedestrian Spine (Former West Reid Street)



View into New Ceremonial Plaza from Langley Boulevard

... continuation of the Master Plan



Proposed Administrative Headquarters Building







Shared Facilities Building Currently, facilities that serve the entire LaRC community are scattered throughout the campus, making their maximum utilization difficult. Consolidating these "shared facilities" into one building will accomplish a number of goals. It will provide a centralized location for the conference center and the cafeteria, two shared facilities that would serve both the LaRC population as well as visitors. Its location along the pedestrian spine and adjacent to the first "civic" plaza will further establish the area as a communal space. Additionally, since the Shared Facility Building will be mostly open at the ground level but flanked by the food and printing services, it will promote a natural extension of this shared space to the civic plaza. This space could be used as a terrace café or lounge since it will have an open-air feeling while still being protected by the elements. The conference center would be located on the second floor and span across this indoor/outdoor space. Consisting of two main conference areas and a central courtyard, the conference center could easily be served by the cafeteria's kitchen downstairs. Loading dock access will be provided on the back of the building from West Taylor Street.

IEO A DALY

...continuation of the Master Plan

Phasing Goals

The implementation of New Town is planned to occur in three (3) phases, with a fourth phase (identified as Phase X) for future building beyond the proposed program. The phasing plan was developed with the following goals:

- 1. *Minimize the Impact of the Moves*: Groups impacted by the proposed new construction, renovation, and demolition should only have to move once. This reduces the moving costs, eliminates swing space cost, and minimizes any operational impact to the groups.
- 2. *Keep Research as the Focus*: Research should be the focus of every phase; therefore every phase of construction should include a new research laboratory building.
- 3. *Minimize the Annual Funds Required:* The Center had identified early in this master planning effort that the maximum amount the Center could draw from its existing budgets, if no other sources of funding were found, was \$13 million/year. Therefore, this budget was used to guide the pace of implementation, recognizing that if additional funding sources were found, the implementation could accelerate.

Funding/Spending Schedule

Consistent with the third goal established above, a funding plan was developed that spreads the entire New Town project implementation over fifteen (15) years. Beginning in Fiscal-Year 2007, the project anticipates drawing the first \$13 million installment of funds. Every year there after, till Fiscal-Year 2021, an additional \$13 million/year is needed. In Fiscal-Year 2022 (the 15th year), only \$5 million will be needed to complete the project. These costs include all hard and soft costs, along with an escalation of 4% per year. (Refer to the next section of this report, *Cost/Benefit Analysis*, for detailed information.)



Projected Funding /Spending for All Three Phases

Diagram of the Development Phases



PHASE X.

... continuation of the Master Plan

Gantt Schedule for New Town Construction/Demolition

ID	Task Name	Duration	Start	Finish 2	2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
1	New Town	884.2 wks	Mon 1/1/07	Mon 12/11/23	2 3 4 1 2 3 4
2	Start New Town in January 2007 (FY 07)	1 day	Mon 1/1/07	Mon 1/1/07	▶ 1/1
3	Phase 1	312 wks	Tue 1/2/07	Mon 12/24/12	
4	Design Demo of 1168 and 1192	26 wks	Tue 1/2/07	Mon 7/2/07	
5	Construction Demo of 1168 and 1192	26 wks	Tue 7/3/07	Mon 12/31/07	
6	Design New Sensor Lab Building	52 wks	Tue 1/2/07	Mon 12/31/07	
7	Construction of New Sensor Lab Building	104 wks	Tue 1/1/08	Mon 12/28/09	
8	Design New Admin. Building	52 wks	Tue 12/29/09	Mon 12/27/10	
9	Construction of New Admin. Building	104 wks	Tue 12/28/10	Mon 12/24/12	
10	Additional Demolition	104 wks	Tue 12/28/10	Mon 12/24/12	
11					
12	Phase 2	364 wks	Tue 12/27/11	Mon 12/17/18	
13	Design Renovation of 1219	52 wks	Tue 12/27/11	Mon 12/24/12	
14	Construction Renovation of 1219	105 wks	Tue 12/25/12	Mon 12/29/14	
15	Design Demo of 1149,1151,1152,1153	26 wks	Tue 12/25/12	Mon 6/24/13	
16	Construction Demo of 1149, 1151,1152,1153	26 wks	Tue 6/25/13	Mon 12/23/13	
17	Design New Shared Use	52 wks	Tue 12/25/12	Mon 12/23/13	
18	Construction of New Shared Use	104 wks	Tue 12/24/13	Mon 12/21/15	
19	Design Demo of 1213	26 wks	Tue 12/22/15	Mon 6/20/16	
20	Construction Demo of 1213	26 wks	Tue 6/21/16	Mon 12/19/16	
21	Design New Laser Lab Building	52 wks	Tue 12/22/15	Mon 12/19/16	
22	Construction of New Laser Lab Building	104 wks	Tue 12/20/16	Mon 12/17/18	
23	Additional Demolition	104 wks	Tue 12/20/16	Mon 12/17/18	
24					
25	Phase 3	364 wks	Tue 12/20/16	Mon 12/11/23	
26	Design Demo of 1229	26 wks	Tue 12/20/16	Mon 6/19/17	
27	Construction Demo of 1229	26 wks	Tue 6/20/17	Mon 12/18/17	
28	Design New NDE Lab Building	52 wks	Tue 12/20/16	Mon 12/18/17	
29	Construction New NDE Lab Building	104 wks	Tue 12/19/17	Mon 12/16/19	
30	Design Demo of 1195	26 wks	Tue 12/17/19	Mon 6/15/20	
31	Construction Demo of 1195	26 wks	Tue 6/16/20	Mon 12/14/20	
32	Design New Admin. Building	52 wks	Tue 12/17/19	Mon 12/14/20	
33	Construction New Admin. Building	104 wks	Tue 12/15/20	Mon 12/12/22	
34	Design Renovation of 1230	52 wks	Tue 12/15/20	Mon 12/13/21	
35	Construction Renovation of 1230	104 wks	Tue 12/14/21	Mon 12/11/23	
36	Additional Demolition	104 wks	Tue 12/14/21	Mon 12/11/23	
Leo A	Daly Task		Progress		Summary External Tasks
Project: Date: Ti	Phasing Plan ue 8/16/05 Split		Milestone	•	Project Summary



Potential Demolition Sites



Phase 1: Demolition



1168-L1192

Phase 1: New Construction



The design and construction for each phase is illustrated on page 17 (Projected Funding/Spending For All Three Phases). Plotted on the chart is a cumulative curve representing the funding stream, along with the curve for spending. Several of the buildings programmed for New Town will require multi-year funding because their cost exceeds the \$13 million annual funding limit.

Phasing

Phase 1

headquarters for the campus.

Phase 2

Phase 2 (2012-2019) has been broken down into two consecutive steps in order to accommodate a complicated sequence of demolitions and new construction on selected sites. The first step will primarily encompass the movement of personnel to new facilities created during Phase 1 and the demolition of existing structures. Personnel from the following groups A, A1-A3, B1-B6, C3-C4, and B4 will be relocated to the newly constructed administrative office building at the southern edge of the Core. The movement of these groups will allow for the demolition of buildings 1149, 1151, 1152, and 1153. Once these buildings have been removed, construction of the new Shared Facilities Building (50,000 GSF) can begin. Additionally, personnel from groups A, A2, B6, C1 and C3 who currently reside in Building 1219 (34,000 GSF) can also be moved over to the new administrative office building; clearing the way for Building 1219's

A Gantt Schedule of phasing plan is provided on the previous page. While the plan focuses on the construction and demolition within the core, there is additional demolition happening outside the core with each phase. Approximately 176,000 GSF of demolition is to be included within each of the three phases of New Town. A map showing 'Potential Demolition Sites' throughout the campus is provided for reference. It is anticipated that the actual buildings to be demolished within each phase will vary depending upon the program and mission in place at that time.

Phase 1 (2007-2013) as illustrated below, on the left, includes the construction of two new buildings within the Core as well as the demolition of two. Phase 1 will kick-off with the demolition of buildings 1168 and 1192. This will clear the way for a new Sensor Instrument Laboratory (55,470 GSF) to be built on the site. Following the laboratory building is the construction of a new administrative office building (114,000 GSF) within the triangular area between Langley Boulevard and former West Walcott and West Durand streets. Because of the building's location near the LaRC's entrance, it has the possibility of becoming the future

Phase 2 – Step 1: Demolition



1151 L1152, 1153, 1149





L1213

1195-L1229





Shared Facility Building [⊥] L1219 Renovation

Phase 2 – Step 2: New Construction



Laser Laboratory

Phase 3: New Construction



Administrative Building Material Evaluation 1230 Renovation & NDE Testing Laboratory

renovation.

In the second step, the Food Service will be moved from Building 1213, the current home of the cafeteria, into the newly constructed shared facility building. Building 1213 will then be demolished and a new Laser Laboratory (33,540 GSF) will be built in its place.

Phase 3

Finally, in Phase 3 (2017-2023), two Core buildings will be demolished to make way for new construction and one will be renovated. Building 1229 will then be demolished and replaced by a new Materials Evaluation/NDE Laboratory (39,990 GSF). Then personnel still remaining in Building 1195, primarily groups, B1, B2, B4 and B6, will be relocated to the new Administrative Building constructed during Phase 1. Once Building 1195 is vacant, the site will be cleared to make way for construction of a new office building (101,000 GSF). Once the new construction is completed, portions of Building 1230 will be renovated (38,000 GSF).

Phase X

Phase X



IED A DALY

Phase 3: Demolition

During the planning for the New Town core area, it became apparent that a fourth laboratory building could reasonably be located along the pedestrian spine between buildings 1205 and 1232. Although no immediate need was identified for this building, the master plan could benefit from its placement to further define the walkway and shield the adjacent parking lot and back-of-building services for Building 1205. Placement of this building demonstrates added flexibility of the New Town master plan, and opportunities within the core for additional new construction.

-Future Laboratory Building



Cost / Benefit Analysis (Econpack)

In order to assess economic returns of various investment options for New Town, this Strategic Concept Plan includes an update to the financial analysis tool known as Econpack used in the first phase of this feasibility analysis. Econpack is a computer-modeling tool developed for DOD to systematically evaluate the most cost-effective way to meet an objective. Econpack is capable of performing two types of analysis: a primary analysis to evaluate the economic impact when changing an existing condition (employed for this project); and a secondary analysis that compares proposed alternatives to satisfy a new requirement.

Approach

In 2004, the study team defined five possible occupancy scenarios to determine if cost savings could be realized by either investing in campus facilities or relocating to leased space off campus. The results of this preliminary analysis revealed that a combination of renovation and new construction was the most economically viable approach for satisfying future occupancy requirements in better guality and more efficient facilities. Therefore, this new and updated analysis focuses only on refining this preferred alternative, New Town, as compared to the Status Quo baseline as follows:

- 1. Status Quo: This is the "do nothing" scenario in which continued occupancy and use of the buildings remains unchanged. This scenario establishes the basis, or benchmark, for comparing other occupancy alternatives.
- 2. New Town Scenario: Selected benefits from renovating existing facilities are combined with constructing new facilities.

The current analysis covers a 25-year period beginning in 2007/2008,

which includes a construction period spread out over a 15-year period followed by ten (10) years of facility operations and maintenance. Both the initial capital investments and annual facility operating expenses are factored into this life cycle cost analysis.

Typical Econpack inputs include construction periods of no more than 5 years followed by twenty (20) years of operations, which collectively comprise the 25-year life cycle analysis. Despite a 15-year construction period, this analysis does not extend the life cycle analysis beyond a 25year period to allow for a longer period of operations because it would require changing the Status Quo scenario significantly. For example, under a 40-year life cycle scenario, close to a full renovation of the existing buildings in the Status Quo scenario would need to be implemented to provide adequate space during this time frame.

Econpack establishes a Net Present Value (NPV) for each scenario from which it can then derive a Savings-to-Investment Ratio (SIR) and a Discounted Payback Period (DPP). These are the two primary criteria used by NASA to determine which alternative is the most financially beneficial course of action.

Methodology (see Econpack analysis in Appendix II)

A summary of the some of the significant model inputs is presented below by input category. The general assumptions used in the Econpack model not already discussed consist of using constant \$2005 dollars (not subject to inflation) discounted to the middle of the year. Occupancy is phased into the new facilities as they are completed through 2022/2023.

Square Footage Calculations

BUILDING DESCRIPTION (Space Type)	STATUS QUO (100% Existing)	NEW TOWN (85% New; 15% Rehab)
Existing GSF	600,000	
Rehabilitated GSF		72,000
New GSF		394,000
Total GSF	600,000	466,000

Status Quo - The total of 600,000 GSF for this scenario reflects the applicable components of the New Town concept: 72,000 GSF of existing office facilities to be renovated plus 528,000 GSF of existing facilities slated for demolition.

New Town – New Town is to be comprised of 330,000 GSF of office. of which approximately 72,000 GSF will be rehabilitated / renovated and 258,000 GSF will be new construction (215,000 GSF of new construction for the Administrative Buildings and 43,000 GSF of new office space for the Laboratory Buildings.) Additionally, new laboratories will account for 86,000 GSF and 50,000 square feet of new special use facilities for a total of 466,000 GSF. This scenario combines 15% renovation with 85% new construction.

The gross square foot reduction between Status Quo and New Town illustrates significant benefits of new construction/renovated space primarily because new space is more efficient both in design and operations resulting in space compression by about 20 to 25%.

Mixture of Uses: Originally, a survey of space for the portfolio of space being examined was broken down into 37% of office uses, 23% for laboratory space and 40% for special purpose uses. Based on an initial assessment of future space requirements at Langley, the previous analysis concluded that the space breakdown should be estimated at 45% office, 30% laboratory and 25% special use. According to a more detailed assessment conducted on a building-by-building basis, actual user requirements and a program of future space needs suggests use components comprised of 71% office, 18% laboratory and 11% special use. Note, however, that newly constructed office space will have accommodations for conference rooms and some components of space characterized as special use.

COST/BENEFIT ANALYSIS

Gross Square Footages – This analysis mimics the more detailed, building specific proposed New Town development compared with the more generic methodology employed in the 2004 study. The square footage use allocations have been adjusted slightly from the original analysis to better reflect the proposed square footage occupancy requirements for the planned New Town project. Based on these New Town development plans and the amount of demolition, the square footage figures for the Status Quo scenario were derived by the study team.

MIXTURE OF USES	STATUS QUO GSF	NEW TOWN GSF
Office (71% of total)	426,000	330,000
Lab (18% of total)	108,000	86,000
Special Use (11% of total)	66,000	50,000
TOTAL	600,000	466,000

Rentable Square Feet (RSF): For each alternative, the average efficiency factors used by GSA in their General Construction Cost Review Guide (GCCRG) to convert gross square feet to rentable square feet was used as follows and has not been modified from the prior analysis:

SF - RSF EFFICIENCY FACTORS	STATUS QUO RSF	NEW TOWN RSF
Office (72.5% efficiency)	308,850	239,250
Lab (58% efficiency)	62,640	49,880
Special Use (68.6% efficiency)	45,276	34,300
TOTAL	416,766	323,430

Existing Asset Contribution

Under the New Town scenario, the 72,200 GSF of office space that is renovated has an estimated "as is" asset value (or cost to the redevelopment) of \$50/GSF or \$3.61 million. This input is premised on the fact that NASA would contribute this asset to the development deal and that it has an associated "inherited" asset value. Since the Status Quo scenario assumes no redevelopment (occupancy as is), no cost has been assigned to the contributed assets.

Capital Outlays

Initial Construction Costs: Construction costs vary based on the type of the space and are segmented into office, laboratory and special use space. Costs represented are based on GSA's GCCRG model keyed to mid-year 2005. The GCCRG estimates comprise only hard construction costs so these cost results were increased by 65% to account for soft costs and FF&E based on both GSA and NASA historical cost allocations.

The soft construction costs are comprised of the following:

- □ 10% for planning and design contingencies
- □ 7% for construction contingencies
- □ 4% for GSA fees
- □ 6% for construction management and construction inspection
- 1% for commissioning
- 9% for A-E design fee
- □ 0.5% for art-in-architecture



Compounding these soft cost factors totals 50%. Added to this amount is NASA funded FF&E costs estimated at 15% (8% for furniture and 7% for communications) for a total mark up of 65%. The cost breakdowns are illustrated below per gross square feet (GSF):

SPACE TYPE	GSA'S GCCRC 2005	PLUS 65% FOR SOFT COSTS & FF&E
New Office	\$151	\$249
New Lab	\$246	\$406
New Special Use	\$170	\$281
Rehabilitated Office	\$114	\$188

No laboratory and special use space is assumed to be renovated so construction costs estimates were not required.

Deferred Maintenance: The Status Quo scenario allocates approximately \$3.0 million (or \$7.34/RSF) for recurring deferred maintenance costs as an investment cost (above the repairs and maintenance recurring operating expenses). In the 2004 analysis, two estimates were provided for recurring operating expenses for repairs and maintenance based on the following assumptions: 2-4% of CRV values equating to \$17.17/RSF; and Langley's FY05 repair and maintenance budget amounting to \$9.83/RSF. We derived the \$7.34/RSF by subtracting the recurring costs for repairs and maintenance described below from the CRV estimate of \$17.17/RSF (\$17.17-\$9.83 = \$7.34/RSF). Total deferred maintenance costs over the 25-year life cycle analysis are \$76.5 million (and are compared to New Town's initial up-front construction costs).

Mitigation Costs: Assumed to be \$5.00 per GSF to account for any environmental and abatement issues. Both the mitigation costs and demolition costs were validated based on recent GSA project expenses elsewhere.

finished space.

Swing Space: No swing space is needed under the New Town scenario. Occupancy is assumed the same as in the status quo scenario until the New Town space is ready for occupancy.

Parking: Based on the GSA's GCCRC, the average cost to replace each parking space is \$3,075. A total of 887 new spaces were determined

Land and Infrastructure Costs: Considered equivalent for each alternative.

Demolition Costs: Assumed to be \$5.00 per GSF.

Direct Move Costs: Is estimated at \$5.00/RSF for renovated space and \$10.00 per RSF for new space and only one move is necessary into the based on future occupancy requirements calculated by using the same input assumption from the 2004 analysis of 2.25 spaces for every 1,000 rentable square feet.

Total Capital Outlays: Initial capital outlays represent the front-end costs for government-paid construction and associated relocation costs. The New Town up front costs are spread out over a 15-year period in conjunction with phased construction. Construction costs, move costs, demolition, mitigation and parking amounts to approximately \$126 million in current dollars. As indicated earlier, the Status Quo scenario has no up front capital costs, incurring instead a \$3.0 million annual deferred maintenance cost reflecting total capital outlays of \$76.5 million over the 25-year life-cycle analysis study period.

Recurring Costs

OPERATING COST	STATUS QUO RSF	NEW TOWN RSF
Repairs and Maintenance	\$9.83	\$1.73
Utilities	\$3.00	\$1.83
Services	\$3.50	\$3.50
Administration	\$0.50	\$0.50
TOTAL OPERATING EXPENSE	\$16.83	\$7.56

Operating Expenses: In each alternative, there are four recurring costs as follows (on a RSF basis):

Repair and Maintenance: Status Quo repairs and maintenance cost input is the same as in the 2004 analysis of \$9.83, which was based on Langley's FY05 budget costs. The New Town estimate is a blended rate calculated based on 85% new space at \$1.50/RSF and 15% rehabilitated space at \$3.00 per RSF.

Utility Costs: Status Quo utility costs input is the same as in the 2004 analysis of \$3.00/RSF. Please note that LaRC has negotiated Government utility rates with Virginia Power, which accounts for the lower estimated costs compared to the private sector. The New Town estimate is a blended rate calculated based on 85% new space at \$1.75 per RSF and 15% rehabilitated space at \$2.25/RSF.

Services and Administrative: Services and administrative costs were assumed to remain the same for each scenario (similar cleaning requirements, etc).

Total Annual Operating Costs: On an annual budgetary basis, Status Quo requires \$7.01 million versus \$2.45 million for the New Town option post construction.



Cumulative Operating Costs: The cumulative operating costs are based on actual input costs from the Econpack model. Status Quo has operating costs of \$7.01 million annually for twenty-five (25) years life cycle analysis. The New Town scenario uses a diminishing percentage of Status Quo operating costs over the 15-year construction period followed by ten (10) years of stabilized operations at \$2.45 million annually.



Depreciation / Residual Values

Depreciation: A straight-line methodology is used employing a 25-year life cycle time frame for renovated space and forty (40) years for new construction. These are the standard/default depreciation time frames used in an Econpack analysis. The basis for the costs to be depreciated replicates the initial construction costs and/or renovation costs. The depreciated building values begin once a building is completed which occurs in three phases spread over the 15-year construction period. Econpack's treatment of any remaining residual value at the end of the investment period is to add it as a cost offset prior to the annual discounting of the cash flows.

Discount Rates: The 2005 OMB Circular A-94 approved real discount rate of 2.95% (extrapolated as the 25-year rate) is used. Operating costs are discounted mid-year since they occur throughout the year while the residual values are discounted at the end of the year.

Findings

SCENARIO	NPV	SIR	DPP
Status Quo	\$179 million		
New Town	\$147 million	1.4	12.3

The Economic Analysis Graph below illustrates the NPV curves for both Status Quo and New Town. The three jagged movements in the New Town Curve reflect the three phases of implementation discussed in the Master Plan. Positive economic results are evident with the implementation of each phase, as well as looking at all three phases of New Town together.



- Meets and exceeds industry return on investment thresholds
- □ Improves the quality of the facilities to market standards
- □ Facilitates space-use compression
- Reduces reliance on future annual repair and maintenance funding
- □ Is less disruptive than incremental Status Quo renovations

The New Town scenario has a lower NPV of \$147 million versus \$179 million for the Status Quo scenario, a SIR of 1.4 and a discounted payback period of 12.3 years. These Econpack results are considered positive in supporting the feasibility of the proposed occupancy scenario.

Other economic-related observations are that New Town:

- □ Enhances the functionality of the campus facilities
- □ Fundamentally enhances the value of other Langley assets

ALTERNATIVE FUNDING APPROACHES

Financing / Alternative Funding Approaches

Concerns with funding have been paramount throughout the entire New Town study period and have been discussed at length with NASA Langley staff. During the study process, issues of funding have driven a number of key planning objectives:

- 1. Seeking lowest cost alternatives led to recommending optimal reuse of select existing facilities.
- 2. The location and sizing of facility investment was tied to complimenting and enhancing the performance and value of existing assets.
- 3. The need for flexibility in implementation (building function, size, timing and possible funding sources) led to a master plan that can accommodate change and uncertainties while providing a framework for overall redevelopment.

Applying the above standards resulted in a master plan that elevates the image and performance potential for Langley so that it can compete as a highly viable investment prospect.

Single Federal Appropriation: Generally, the least costly and most straightforward source of funding is to secure a Congressional capital budget allocation to go forward with the entire redevelopment program. While this "traditional" approach has become more difficult to orchestrate in contemporary times, it remains a benchmark for economic analysis, and in the instance of New Town, is considered to be very appropriate. Not only does the economic analysis verify substantial investment period returns, but the NASA Langley mission is unusually well served by such a repositioning of its campus research effectiveness compared with standard one-off type generic building expenditures. Putting some order of magnitude on the scale of reinvestment that a single appropriation for funding would entail, the total project is budgeted in current dollars at less than 5% of the Langley campus's current replacement value of \$2.62 billion.

Phased Government Funding: As an alternative to a single federal appropriation, this Strategic Concept Plan for New Town looked at a multiyear option sourced to some degree from redirecting current NASA facility budget support. An annual fixed budget allocation would entail stretching the phased development period to 15 years, which has been illustrated in the modified Econpack model presented herein. While the cost impacts of extending the development period in escalated dollars are substantial - increasing the end period budgets by upwards of 50% over what near term construction would cost - such annual capital outlays still represent well less than 1% of the overall current CRV for Langley.



Alternative Funding Approaches: Though the Strategic Concept Plan modeled the economic analysis premised on some form of direct or modified government funding assumptions, much consideration went into alternative funding that might be feasible for New Town. In the formation of the proposed master plan, accommodating different funding scenarios was important, not only as a flexible approach to address prevailing federal funding, but as a means to engage private sector investment if the opportunity became available. Examples of funding alternatives that have been considered include:

Enhanced-Use Leasing (EUL). NASA currently has two enhanceduse lease projects underway, in California and Florida. This authority could potentially be expanded to support projects at Langley; but does not exist today. (With the extensive use of contractors in the workforce at Langley, there appears to be a ready market for private sector investment.) Currently, only the Department of Defense and Department of Veteran Affairs has this authority. Enhanced-Use leases are essentially ground leases. OMB says if the ground lease is for 50 years, and the government doesn't participate, then what is done on the property is private. When the private sector builds a building on the leased ground, with the intent to lease the new building back to the government, the lease is scored by OMB as either an operating lease or a capital lease. (See OMB Circular A-11.) The six criteria that must be met in order for a lease to be considered an operating lease instead of a capital lease (per OMB Circular A-11) are:

- life of the asset.

1. Ownership of the asset must remain with the lessor during the term of the lease and is not transferred to the government at or shortly after the end of the lease term.

2. The lease does not contain a bargain-price purchase option.

3. The lease term does not exceed 75% of the estimated economic

4. The asset is a general purpose asset rather than being for a special purpose of the government, and is not built to unique specifications of the government lessee.

5. There is a private sector market for the asset.

6. The present value of the minimum lease payments over the life



of the lease does not exceed 90% of the fair market value of the asset at the beginning of the lease term.

- □ Capital Lease. A public private sector investment in facilities, that NASA would want to then lease, would potentially be a capital lease subject to OMB scoring. Locating the lease facility on NASA property would require and EUL.
- □ **Historic Preservation Act**. Historic, adaptive re-use, is always a way for enabling private investment in federal facilities under the Historic Preservation Act. There are precedents for this with a NASA wind tunnel and GSA facilities in Washington.
- The National Aeronautics and Space Act. The National Aeronautics and Space Act of 1958, amended in Pub. L. No. 85-568, does not specifically give NASA EUL authority, or specify how private sector investment might be engaged. However, it does authorize the Administration "to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities..."
- Cooperative Agreement w/Air Force. Since the Department of Defense has EUL authority, there may be opportunity to do a cooperative project with the Air Force using their authority.

- Langley.

The identification of the Long-Term Expansion zone established a reserve of property for future development that potentially has its own access from the secondary entrance to the campus. For private sector to invest in facilities on federal property, investors typically want assurances that the facilities could be used by the private sector if there is ever a time when the federal interest in leasing disappears. Since this zone has its own entrance, the secure perimeter around Langley could theoretically move, if needed, placing this section outside the fence. Similarly, by expanding the Proposed Core to the public roadway, facilities built along the perimeter fence could shift from federal occupancy to private sector use by moving the security fence.

The use of multiple buildings, instead of one complex of facilities, in the Master Plan provides more opportunity for the private sector to engage in one or more of the facilities where they see potential market returns on their investment.

□ Interagency Agreement. The trash burner that generates steam for NASA was implemented under a cooperative agreement between the City, the Air Force, and NASA...on NASA land. NASA retained the property, controlled the design and construction, and then out-leased the operations to the City. Both the Air Force and NASA contributed funds to built the trash burner; and agreed to utilize the facility to manage its trash rather than sending it to the City landfill.

ESPC. The Energy Services Procurement Contract (ESPC) just got reinstated. Under this authority, the federal government can bring approved energy providers in to invest in equipment or facilities that utilize energy...as a means for improving energy efficiencies and lowering energy usage costs for the government. For their investment in facilities, the private sector energy provider gets a long-term contract to sell energy services.

PPEA. The State of Virginia in 2002 signed into legislation the Public Private Education Act as a tool for inviting private sector money to invest in State facilities. Since the Langley Center is a major employer in the State, the State may be willing to use its authority to help engage private investment on NASA property. However, the mechanism that would allow the State to lease NASA land might still require an EUL.

Some of the planning features of the Master Plan that hold potential for private sector investment at Langley include: the Long-Term Expansion zone located near the secondary entrance to the campus, the expanded Proposed Core that extends to the public roadway, and the use of multiple buildings versus one complex to respond to the program needs of

APPENDIX D

RESULTS OF PHASE I ARCHITECTURAL SURVEY

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	Phase I Reconnal	ssance Level Surve	y of Lake s	s Arcinio	ectural Resources
Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
581	114-0165-0355	Noncontributing		1940	Thornell Avenue Substation
582	114-0165-0356	Individually and contributing	А	1921	East Compressor Building
582A	114-0165-0357	Individually and contributing	А	1940	Low-Turbulence Pressure Tunnel
636A	114-0165-0358	Noncontributing		1980	Satellite Dish
640	114-0165-0359	Individually and contributing	A,C	1953	8-Foot Transonic Pressure Tunnel
641A	114-0165-0360	Noncontributing		1970	Storage Building
641B	114-0165-0361	Noncontributing		1970	Cooling Tower
642	114-0165-0362	Noncontributing		1941	Back River Substation
644	114-0165-0363	Individually and contributing	A,C	1939	12-Foot Low-Speed Tunnel
645	114-0165-0364	Individually and contributing	A,C	1941	20-Foot Free Spinning Tunnel
645A	114-0165-0365	Noncontributing		1979	Spin Tunnel Support Building
646	114-0165-0366	Individually and contributing	А	1934	Engineer Technology Laboratory
647	114-0165-0367	Individually and contributing	A,C	1939	Rotor Aeroelastic Laboratory
648	114-0165-0368	Individually and contributing	A,C	1938	Transonic Dynamics Tunnel
648A	114-0165-0369	Noncontributing		1979	Transonic Dynamics Tunnel Complex
648B	114-0165-0370	Noncontributing		1979	Transonic Dynamics Tunnel Complex
650	114-0165-0371	Noncontributing		1938	Mathis Road Substation
1133B	114-5313-0148	Noncontributing		1983	Satellite Dish
1146	114-5313-0010	Individually and contributing	A,C	1941	16-Foot Transonic Tunnel
1146A	114-5313-0078	Noncontributing		1958	16-Foot Transonic Tunnel Complex
1146B	114-5313-0079	Noncontributing		1959	16-Foot Transonic Tunnel Complex
1146C	114-5313-0080	Noncontributing		1941	16-Foot Transonic Tunnel Complex
1146D	114-5313-0081	Noncontributing		1970	16-Foot Transonic Tunnel Complex
1146E	114-5313-0082	Noncontributing		1941	Newport News Waterworks Pump House
1146F	114-5313-0083	Noncontributing		1941	Big Bethel Reservoir Valve House
1146G	114-5313-0084	Noncontributing		1941	16-Foot Transonic Tunnel Complex
1146H	114-5313-0085	Individually and contributing	A,C	1941	16-Foot Transonic Tunnel Complex
1146I	114-5313-0086	Individually and contributing	A,C	1941	16-Foot Transonic Tunnel Complex

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Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
1146J	114-5313-0087	Noncontributing		1941	16-Foot Transonic Tunnel Complex
1146K	114-5313-0088	Individually and contributing	А	1941	16-Foot Transonic Tunnel Complex
1146L	114-5313-0089	Noncontributing		1941	16-Foot Transonic Tunnel Complex
1146M	114-5313-0090	Contributing	А	1941	16-Foot Transonic Tunnel Complex
1147	114-5313-0011	Noncontributing		1940	Taylor Road North Substation
1148	114-5313-0012	Individually and contributing	А	1940	Structures & Materials Research Lab
1149	114-5313-0013	Contributing	А	1941	Dispensary Office of Patent Counsel
1151	114-5313-0150	Noncontributing		1971	Management Support
1152	114-5313-0014	Contributing	А	1941	Publications Editorial Office
1153	114-5313-0015	Contributing	А	1941	External Affairs
1168	114-5313-0170	Noncontributing		1976	Flight Control Research Building
1191	114-5313-0191	Noncontributing		1993	Support Offices
1192	114-5313-0016	Contributing	А	1942	Financial Management Division
1192C	114-5313-0188	Noncontributing		1942	Impact Basin Office Building
1192D	114-5313-0189	Noncontributing		1966	Projects Directorate
1192E	114-5313-0190	Noncontributing		1966	Scout Project Office
1194	114-5313-0017	Contributing	А	1942	Library
1194A	114-5313-0191	Noncontributing		1977	West Area Training Facility
1195	114-5313-0192	Noncontributing		1966	Financial Management and Procurement Building
1195A	114-5313-0193	Noncontributing		1966	Fiscal & Procurement Building Annex
1195B	114-5313-0194	Noncontributing		1972	Fin. Management Division, U.S. Army Lab
1195C	114-5313-0195	Noncontributing		1977	Administrative Management Building
1197	114-5313-0197	Noncontributing		1991	Storage Building
1200	114-5313-0200	Noncontributing		1965	Laser Optics Laboratory
1200A	114-5313-0201	Noncontributing		1965	Research Support
1212	114-5313-0018	Contributing	А	1946	Subsonic Tunnels Facility
1212B	114-5313-0091	Individually and contributing	A,C	1946	High-Speed 7 x 10-Foot Tunnel
1213	114-5313-0019	Contributing	A	1946	Cafeteria Telephone Exchange
1214	114-5313-0215	Noncontributing		1970	Basic Aerodynamics Research Tunnel

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Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
1215	114-5313-0020	Contributing	А	1946	Central Heating & Steam Generation
1218	114-5313-0021	Contributing	А	1945	Psychoacoustics & Anechoic Noise Facility
1218A	114-5313-0092	Contributing	А	1945	Anechoic Noise Facility
1219	114-5313-0022	Individually and contributing	А	1945	Langley Research Center Headquarters
1220	114-5313-0023	Individually and contributing	А	1945	Management Information Systems Simulation
1221	114-5313-0024	Contributing	А	1946	High-Intensity Noise Research Facility
1221B	114-5313-0093	Contributing	А	1945	High-Intensity Noise Research Facility
1221C	114-5313-0094	Contributing	А	1946	High-Intensity Noise Research Facility
1221D	114-5313-0095	Contributing	А	1946	High-Intensity Noise Research Facility
1221E	114-5313-0096	Contributing	А	1946	High-Intensity Noise Research Facility
1222	114-5313-0025	Noncontributing		1946	Employee Activities Conference Center
1223	114-5313-0026	Noncontributing		1943	Pollution Control
1223A	114-5313-0219	Noncontributing		1975	Pollution Control Plant
1225	114-5313-0027	Contributing	А	1945	Experimental Machine Shop
1228	114-5313-0028	Contributing	А	1948	Main Gate House
1229	114-5313-0029	Contributing	А	1945	Loads, Structures, & Dynamics Research
1229A	114-5313-0097	Contributing	А	1945	Chemical Storage
1229B	114-5313-0098	Noncontributing		2000	High Speed Research Facility Storage
1230	114-5313-0030	Contributing	А	1945	Instrumentation Research
1230A	114-5313-0099	Contributing	А	1946	Gas Flow Calibration Lab
1230B	114-5313-0225	Noncontributing		1988	Gas Flow Calibration Lab
1231	114-5313-0031	Noncontributing		1946	Child Development Center
1231A	114-5313-0100	Contributing	А	1946	Astronomy Club Facility
1232	114-5313-0032	Contributing	А	1946	Space Technology
1232A	114-5313-0101	Contributing	А	1946	Structural Fabrication Support Administration Offices
1232B	114-5313-0227	Contributing	А	1956	Glass Blowing Shop
1233	114-5313-0033	Noncontributing		1946	Stratton Road Substation
1234	114-5313-0034	Contributing	А	1945	Jet Exit Test Facility
1235	114-5313-0035	Contributing	А	1947	Frequency Converter Building

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Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
1236	114-5313-0036	Contributing	А	1947	National Transonic Facility (NTF)
1236A	114-5313-0103	Contributing	А	1947	National Transonic Facility (NTF)
1237A	114-5313-0231	Noncontributing		1971	Foundry
1237B	114-5313-0232	Noncontributing		1971	Foundry
1237C	114-5313-0233	Noncontributing		1971	Foundry
1238	114-5313-0234	Noncontributing		1975	Laser/Optics Lab
1238A	114-5313-0235	Noncontributing		1978	Composite Model & Metal Finishing Shop
1239	114-5313-0037	Noncontributing		1945	Taylor Road Substation
1240	114-5313-0038	Noncontributing		1951	Ready Issue Stores Building
1241	114-5313-0039	Contributing	А	1951	Tunnel Power Control
1242	114-5313-0040	Contributing	А	1945	0.3-Meter Transonic Cryogenic Tunnel
1243	114-5313-0041	Noncontributing		1950	Yorktown Road Substation
1244	114-5313-0042	Individually and contributing	А	1951	Research Aircraft Operations
1244A	114-5313-0104	Noncontributing		1951	Water Tank No. 2
1244B	114-5313-0105	Noncontributing		1955	Viking Lander Impact Test Facility
1245	114-5313-0043	Noncontributing		1952	General Storage Building No. 1
1246	114-5313-0044	Noncontributing		1952	General Storage Building No. 2
1247A	114-5313-0106	Individually and contributing	А	1952	High Speed Aerodynamics Division Lab Offices
1247B	114-5313-0107	Contributing	А	1952	High Speed Aerodynamics Div. Complex West Wing
1247C	114-5313-0108	Contributing	А	1952	Gas Dynamics Cooling Tower
1247D	114-5313-0109	Contributing	А	1952	Aero-Physics Laboratory
1247E	114-5313-0110	Contributing	А	1952	Gas Dynamics Compression Building
1247F	114-5313-0111	Noncontributing		1952	Ames Road Substation
1250	114-5313-0136	Noncontributing		1968	Environmental and Space Sciences
1250A	114-5313-0137	Noncontributing		1967	Environmental and Space Sciences
1250CTI	114-5313-0138	Noncontributing		1979	Substation
1251	114-5313-0045	Contributing	А	1952	Unitary Plan Wind Tunnel
1251A	114-5313-0112	Individually and contributing	А	1952	Continuous Flow Hypersonic Tunnel
1251B	114-5313-0113	Contributing	A	1952	Chemical Treatment Facility
1251C	114-5313-0114	Contributing	A	1952	Sprinkler House

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Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
1251D	114-5313-0115	Contributing	А	1952	Hypersonic Flow Apparatus
1251E	114-5313-0116	Contributing	А	1952	Hypersonic Flow Apparatus
1254	114-5313-0046	Noncontributing		1954	Radiation Waste Storage
1255	114-5313-0047	Noncontributing		1955	General Storage Building No. 3
1256	114-5313-0048	Noncontributing		1958	Engineering Drawing Files Building
1256A	114-5313-0117	Noncontributing		1958	Combined Loads Testing Facility
1256B	114-5313-0118	Noncontributing		1999	Combined Loads Testing Facility
1256C	114-5313-0119	Noncontributing		2003	Integrated Test Facility
1257	114-5313-0049	Individually and contributing	A,C	1956	Aircraft Landing Loads & Traction Facility
1257N	114-5313-0120	Individually and contributing	A,C	1956	ALDF Complex
12578	114-5313-0121	Individually and contributing	A,C	1956	ALDF Complex
1258	114-5313-0050	Contributing	A,C	1953	Landing Loads Track Compressor Building
1258A	114-5313-0122	Noncontributing		1976	Outdoor Anechoic Gear Building
1259	114-5313-0051	Contributing	А	1953	North Arresting Gear Housing
1259A	114-5313-0123	Contributing	А	1956	Refrigeration Building
1260	114-5313-0052	Contributing	А	1953	South Arresting Gear Housing
1261	114-5313-0053	Contributing	А	1953	Landing Loads Track Shop
1262	114-5313-0054	Contributing	А	1956	High Speed Hydrodynamics Office and Shop
1265	114-5313-0057	Noncontributing		1960	8' High-Temperature Structures Tunnel
1265A	114-5313-0124	Noncontributing		1960	Bottle Storage Building
1265B	114-5313-0125	Noncontributing		1960	Combuster Building
1265C	114-5313-0126	Noncontributing		1960	Cooling Tower and Equipment Building
1265D	114-5313-0127	Noncontributing		1960	Fuel Comp. Equipment Building
1265E	114-5313-0128	Noncontributing		1960	Storage Buildings
1265F	114-5313-0129	Noncontributing		1960	Thermal Protection Systems Test Facility
1265G	114-5313-0130	Noncontributing		1960	Gas Bottle Storage
1265H	114-5313-0131	Noncontributing		1975	Storage Building
1266	114-5313-0058	Noncontributing		1960	Moffett Road Substation
1267	114-5313-0059	Noncontributing		1960	Thermal Protection Research Lab
1267A	114-5313-0132	Noncontributing		1960	Materials Development Shop

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Structure or Building Number	VDHR Number	National Register Eligibility*	Criteria**	Year Built	Name of Building
1268	114-5313-0060	Noncontributing		1960	Data Reduction Center
1284A	114-5313-0133	Noncontributing		1960	Systems Safety Quality Rehabilitation
1286	114-5313-0068	Noncontributing		1960	Rocket Assembly & Propellant Alteration Bldg
1287	114-5313-0069	Noncontributing		1961	41-Foot Vacuum Sphere Shop
1289	114-5313-0070	Noncontributing		1957	Maintenance Shop-Coatings Contractor
1290	114-5313-0071	Noncontributing		1961	Substation Unitary Plan Wind Tunnel
1291	114-5313-0072	Noncontributing		1961	Pump Station (Sewage)
1292	114-5313-0073	Noncontributing		1960	Construction and Repair Shop
1292A	114-5313-0274	Noncontributing		1975	Construction Storage
1295	114-5313-0075	Noncontributing		1963	Shop & Instrumentation for 60' sphere
1295D	114-5313-0284	Noncontributing		1975	Storage Building
1296	114-5313-0077	Noncontributing		1963	Ceramic Spray Shop
1297B	114-5313-0287	Noncontributing		1969	Impact Dynamics Cable Storage
1297F	114-5313-0290	Noncontributing		1965	Lunar Landing Support Facility
1297G	114-5313-0135	Noncontributing		1965	Impact Dynamics Research Facility
1299A	114-5313-0292	Noncontributing		1965	Storage Building
1299B	114-5313-0293	Noncontributing		1965	Storage Building
1299C	114-5313-0294	Noncontributing		1965	Storage Building

*National Register Eligibility

Individually and Contributing – identified as potentially eligible for listing in the National Register as both an individual resource and as a contributing element to the proposed historic district *Contributing* – identified as potentially eligible for listing in the National Register as a contributing resource to the proposed historic district

Noncontributing – determined to be a non-contributing resource

**Criteria (as established by the National Historic Preservation Act)

A: associated with events that have made a significant contribution to the broad patterns of our history.

B: associated with the lives of persons significant in our past.

C: Embodies distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

D: Has yielded, or may be likely to yield, information important in prehistory or history.

APPENDIX E

METRIC/BRITISH CONVERSION TABLES

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Common Length Conversions

Metric Unit	British Unit
Centimeter	0.39 inches
Meter	3.28 feet
Meter	1.09 yards
Kilometer	0.621 miles

British Unit	Metric Unit
Inch	25.4 millimeters
Foot	0.305 meters
Yard	0.914 meters
Mile	1.61 kilometers

Common Area Conversions

Metric Unit	British Unit
Square meter	10.764 square feet
Square meter	1.195 square yards
Hectare	2.47 acres
Square kilometers	0.386 square miles

British Unit	Metric Unit
Square foot	0.093 square meters
Square yard	0.836 square meters
Acre	0.405 hectares
Square mile	2.59 square kilometers

Common Volume Conversions

Metric Unit	British Unit
Liter	2.1 pints
Liter	0.26 gallons

British Unit	Metric Unit
Pint	0.47 liters
Gallon	3.8 liters

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