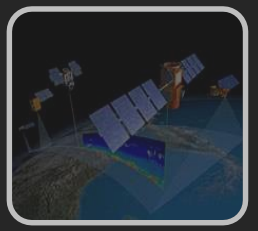
NASA Langley Research Center Revitalization

AERONAUTICS



SCIENCE

SPACE TECH

HUMAN EXPLORATION

We Deliver on Today's Commitments and Prepare for Tomorrow's Opportunities

Agenda

- NASA Langley Research Center (LaRC) at a Glance
- LaRC Revitalization/Master Plan
  - Framework
  - Outcomes
- LaRC's 20-Year Project Plan
- LaRC Deconstruction Projects
- Near Term Projects
  - Horizontal Infrastructure
  - Measurement Systems Laboratory
  - B1230 East Wing Renovation
- How To Do Business with LaRC

NASA Langley at a Glance (2016)

As of 2/1/16

Langley's Economic Impact (2015)

- National economic output of ~$2.3b and generates over 17,400 high-tech jobs
- Virginia economic output of ~$1.1b and generates over 8,800 high-tech jobs
- Within Virginia, executed $155m or 49% of obligations to small businesses

PY2016 Budget Estimate ..... **~$914m**

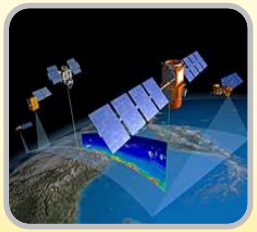
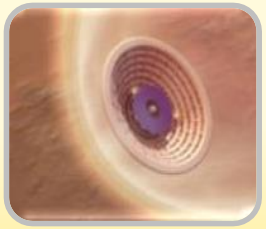
NASA Langley Budget ..... **~$891m**
External Business ..... ~$23m

Workforce ..... **~3,410**
Civil Servants ..... ~1,830
Contractors (on/near-site) ..... ~1,580

Infrastructure/Facilities

156 Buildings ..... 764 acres
Replacement Value ..... ~$3.6b

AERONAUTICS	SCIENCE	SPACE TECH	HUMAN EXPLORATION	EDUCATION
$189m	**$235m**	**$32m**	**$41m**	**$1m**

SAFETY, SECURITY & MISSION SERVICES & CONSTRUCTION/ENVIRONMENTAL COMPLIANCE & RESTORATION

Center Management & Operations
(Facilities, IT, Engineering, Tech Authority, B&P, IRAD, Safety/Mission Assurance, Legal, Finance, Procurement, Human Resources)

Agency Management & Operations
(NASA Engineering & Safety Center, Office of Chief Engineer, Agency IT)

Construction Environmental Compliance & Restoration
(Revitalization Plan)

Aging Infrastructure Poses Risk to Mission

- Agency-wide, more than 80 percent of NASA's infrastructure and facilities by value are beyond their design life – thus more likely to be unsuitable for current and future missions.
  - Aging, Apollo-era legacy infrastructure is inefficient and costly to maintain and operate.
  - Assets over 40 years old (typical design life is 30 years) pose a risk to NASA's unique research and development mission.
- Risk severity rises as assets age beyond 40.
  - To control risk, control the share and average age of assets >40
- Maintenance backlog continues to grow.

Whitlow – "NASA Facility Strategy Presentation" at the 2011 Facilities Engineering Conference

LaRC's oldest building is close to 80 years old and the Center average is 44 years old – We are proactively revitalizing the Center's core infrastructure to meet future missions.

LaRC Revitalization Framework

- Langley will provide concept-to-flight solutions
  - Address increasingly complex research solutions
  - Leverage multi-disciplinary integrated systems capability
- Langley will remain a preeminent research facility
  - Sustain/enhance essential in-house experimental capability
  - Support Aeronautics, Science, Space Tech, Human Exploration
- Langley will embrace new technologies to meet the mission
  - Incorporate computational simulation as a cross-cutting capability in everything we do
  - Implement environmentally-friendly solutions
- Langley will be agile and adaptive
  - Continually assess the needs of NASA's missions and divest of facilities (even large ones) when it no longer makes sense for the mission and the national good

LaRC Master Plan: Outcomes

Relevance to the NASA Mission

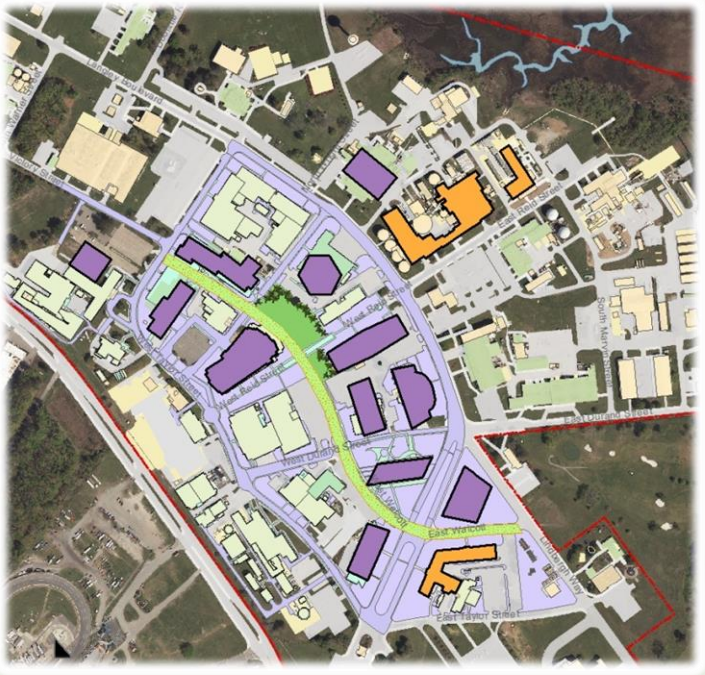
- Facilities exist to **implement programs**
- Infrastructure **flexible** to support a **diversified portfolio**
- Provides **relevant capabilities** for current and future missions

Utilization / Cost of Ownership

- Increases infrastructure **reliability** (reducing growth of deferred maintenance)
- Ensures appropriate **work space quality**
- Fosters **productivity and collaboration**

Master Plan: Agency Metrics

- Follows Agency **Similar-Smaller** approach
- Ensures **CRV** reduction
- Reduces **Energy / Water / GHG**
- Meets **Federal, State & Local regulations**
- Considers **Climate Change impacts**



New/Rehab Construction Projects

In Chronological Order

Rehab / Mod | New Construction

FY Start	Description
2011	**Integrated Engineering Services Building (IESB):** R&D Engineering Design Studio, Flight Mission Support Center, conference center, collaboration space, training class rooms and cafeteria.
2013	**Facility Upgrade to B1247 Aerosciences Research Facility: Consolidate and repurpose three research wind tunnels** to compliment/ enhance Supersonic and Hypersonic research capability; 20” SWT, SLDT, SAJF, Arc Heated Scramjet, M8 VDT & M6 NTC
2014	**Computational Research Facility:** a state-of-the-art consolidated data center that allows for advanced computational research and development in a new energy efficient and sustainable facility
2016	**B1230 East Wing Renovation for Safety-Critical Avionics Laboratories:** Conducts cutting-edge research that will produce innovative concepts, tools, and technologies to improve the safety of current and future aircraft
2016-18	**Electrical Distribution System** (5 phases): modernize LaRC's aging electrical infrastructure by transitioning to a 22-kilovolt (kV) primary loop configuration that provides a more efficient and reliable system with reduced maintenance costs.
2016	**Lab: Measurement Systems Lab**: State-of-the-art Laser/Lidar and Electromagnetics lab; integrates similar groups and functions from across the Center allowing for system engineering solutions that span concept-to-flight instrumentation research and development

New/Rehab Construction Projects

In No Particular Order

Rehab / Mod | New Construction

Description
Research Air Compressor Replacement (4 phases): Replaces all 6 compressors and associated ancillary systems with four 8 lb/sec @ 6,000 psi compressor system that provides a more efficient and reliable system with reduced maintenance costs.
Materials Research Laboratory: Provides state-of-the-art, flexible, adaptable laboratories for development of new multi-functional materials including polymers, metal alloys, and nano-materials for future applications for aerospace vehicles.
Flight Dynamics Research Facility: A unique experimental capability for a comprehensive suite of flight dynamics and controls research capabilities in a single highly automated facility with low operational and maintenance costs
Integrated Systems Development Laboratory: Includes fabrication, environmental test and Science labs: provides an end-to-end fabrication, development and system qualification capability for Science Missions
Intelligent Flight Systems: Autonomy
Lab: Structures; Acoustics; Flight Simulators; Crew Systems; etc.

Deconstruction Projects

- LaRC will divest of infrastructure as we renew and modernize the Center
  - Office buildings
  - Warehouses
  - Research structures
  - Equipment

- LaRC plans to have 1-2 deconstruction projects each year over the next five years

Horizontal Infrastructure Projects

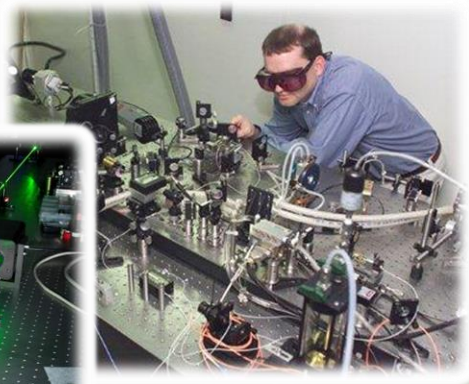
- Potable Water and Metering
  - Replaces existing sections of deteriorated underground cast iron water piping with new PVC piping from the water distribution system piping to various buildings; repair the water tower; and install new advanced water meters strategically located to monitor consumption and provide early detection and location of underground water leaks.

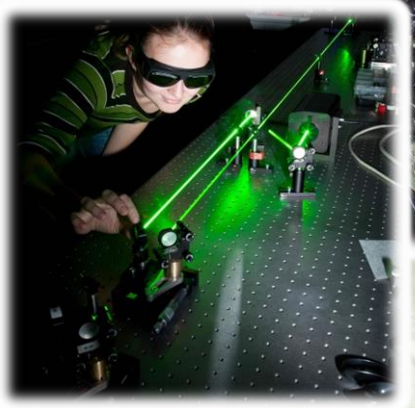
- Electrical Distribution System Upgrades
  - Transitions infrastructure to a new 22 KV redundant loop distribution system; establishes infrastructure for new construction projects; initiates gradual elimination of the 2.4kV and 6.9kV distribution systems.
  - Replaces aging unit substations and associated equipment

- Compressor Station Replacement
  - Replaces existing six compressors (and associated foundations and ancillary systems) with new 8 lb/sec (minimum) @ 6,000 psi compressors (and associated foundation and ancillary systems); replaces the oil-water separator system and condensate floor drains.

Measurement Systems Lab

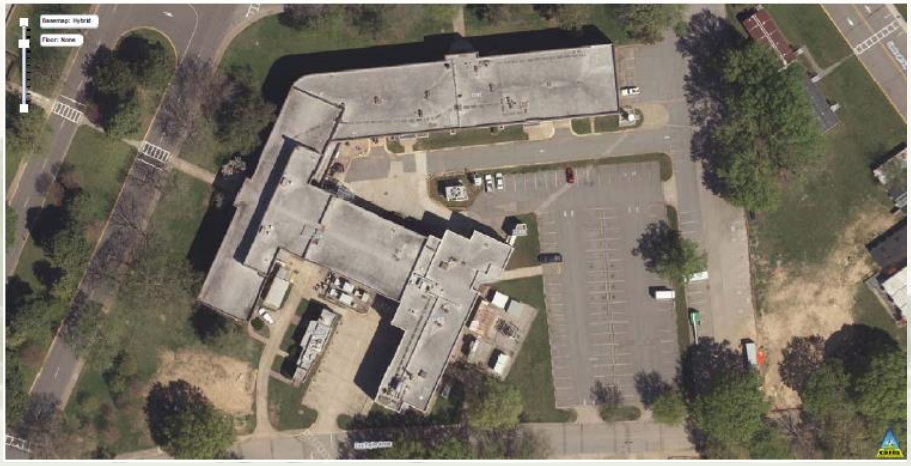
- State-of-the-art Laser/Lidar and Electromagnetics lab
- New Laboratory will integrate similar groups and functions from across the Center allowing for system engineering solutions that span concept-to-flight instrumentation research and development
- FY16 Discrete project to design and construct a ~175,000 square foot multi-story Measurements Systems Lab
- Working with GSA on design
- Funding Source: Recapitalization





B1230 East Wing Renovation

- Project Requirement: Provide 24,000 sq. ft of laboratory space in B1230 for the Safety Critical Avionics Labs and personnel located in B1220.
- Description: Total renovation of east wing of B1230 to include HVAC, electrical, interior finishes (walls, ceilings, and floors) and restrooms.
- Driving Requirement: Provide laboratory/office space for the habitants of B1220 so that building can be demolished.



How to do business with LaRC

- **NASA Direct**: LaRC Office of Procurement

- **CMOE**: LaRC's **C**enter, **M**aintenance, **O**perations, and **E**ngineering Contractor.
  - Jacobs Technology (Prime)
  - Analytical Services & Materials
  - Sierra Lobo
  - Newport News Shipbuilding
  - Genex Systems.

- **USACE/Norfolk District**: Design/Construction

- **GSA/Mid-Atlantic Region**: Design/Construction

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