



NASA Sustainability Highlights

Presentation to DoE/FEMP InterAgency Sustainability Working Group

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Design, Construction and Demolition Branch
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Office of Strategic Infrastructure Facilities and Real Estate Division

Strategic Planning

Real Estate

Maintenance
& Operations

Design, Construction
and Demolition

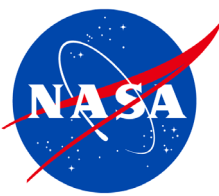


Sustainable Facilities

Topics

- NASA OSI Strategic Goals
- Agency Master Plan (AMP)
- Asset Inventory Assessment (AIA)
- Resilience Planning
- Energy Projects
- EBCx through Enhanced Use Lease
- Demolition/Consolidation Programs
- New Construction and Renovation

NASA Sustainability Highlights

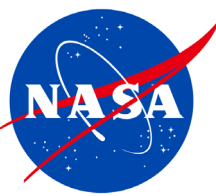


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Strategic Goals and Strategic Objectives

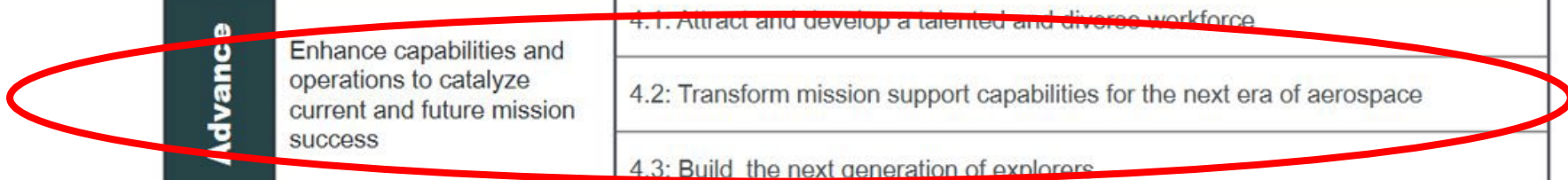
Theme	Goal Statement	Objective Statement
Discover	Expand human knowledge through new scientific discoveries	1.1: Understand the Earth system and its climate
		1.2: Understand the Sun, solar system, and universe
		1.3: Ensure NASA's science data are accessible to all and produce practical benefits to society
Explore	Extend human presence to the Moon and on towards Mars for sustainable long-term exploration, development, and utilization	2.1: Explore the surface of the Moon and deep space
		2.2: Develop a human spaceflight economy enabled by a commercial market
		2.3: Develop capabilities and perform research to safeguard explorers
		2.4: Enhance space access and services
Innovate	Catalyze economic growth and drive innovation to address national challenges	3.1: Innovate and advance transformational space technologies
		3.2: Drive efficient and sustainable aviation
Advance	Enhance capabilities and operations to catalyze current and future mission success	4.1: Attract and develop a talented and diverse workforce
		4.2: Transform mission support capabilities for the next era of aerospace
		4.3: Build the next generation of explorers

NASA Sustainability Highlights

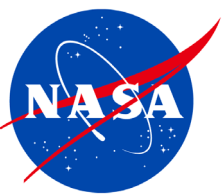


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Agency Master Plan/Asset Inventory Assessment



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Agency Master Plan Vision

“Provide and sustain Agency foundational infrastructure and assets enabling and inspiring the missions and people of NASA today and looking forward to the future.”

Goals

- 1: Mission Driven & Adaptable to Transformation
- 2: Stakeholder Accountability
- 3: Affordable Portfolio
- 4: Risk Mitigation
- 5: Sustainability Best Practices
- 6: Inspire our Workforce

Intent / Benefits

1. **Identify a Mission Aligned Portfolio**
 - Clear Tie to Mission Requirements for Assets
 - Integrated Asset Management
2. **Mission-Driven Business Case** to enable Agency Funding Requests
 - Standardized Mission Relevance (MR) Scoring
 - Collaboratively Managed Agency Assets
3. **Budget Recommendations for Portfolio Management**
 - Data-driven Affordability Metrics
 - Agency Capital Investment Program Plan (CIPP)
4. **Standardized Master Planning Guidance**
 - NASA Planning Checklist

AMP/AIA Drivers

Affordability Challenges

1. Large Property Holdings

NASA is the 9th largest property holder in the federal government

2. Funding Gap

NASA is not the 9th largest in funding

3. Aging Infrastructure

A growing funding gap leads to an inability to proactively sustain our aging infrastructure needed to support **mission requirements**

Examples of Infrastructure Degradation



MAF Roof



GRC Electrical System



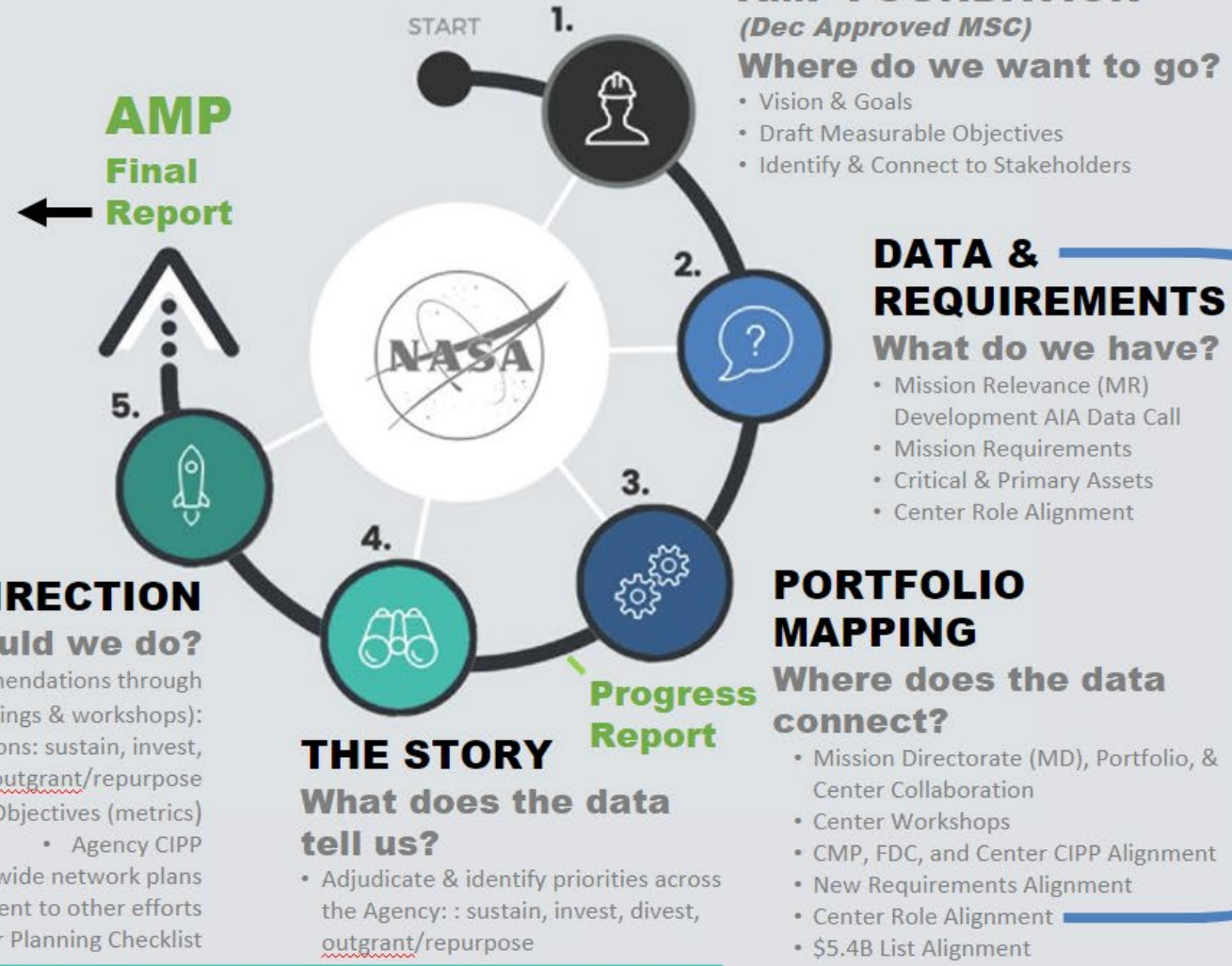
JSC Potable Water



Essential Bridges

AMP/AIA Process

To successfully enable mission and data-driven decisions, the Agency Master Plan (AMP) must be rooted in collaborative data synthesis and analysis.



Asset Inventory Assessment AIA
(Asset Priorities)







AMP
(Project Priorities)



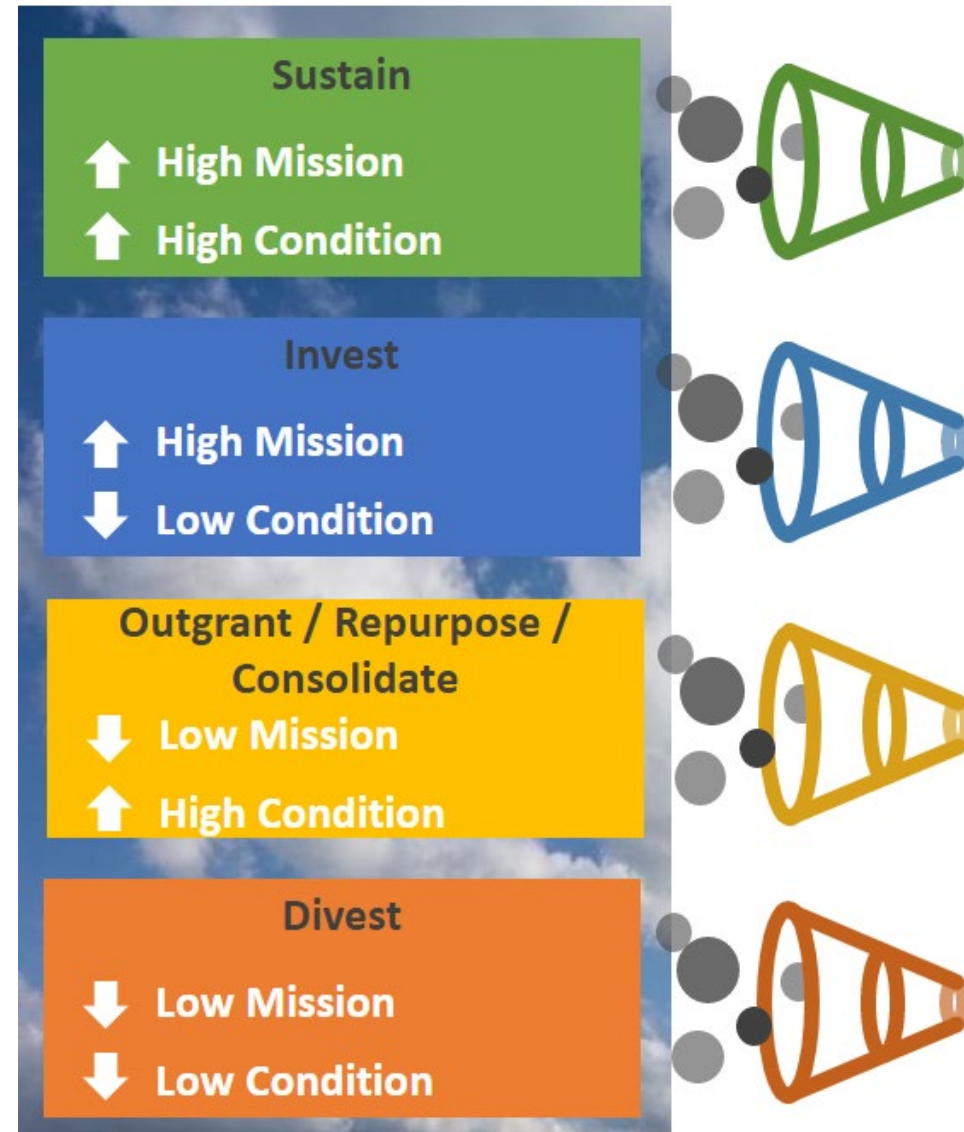
AMP/AIA Process



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GOALS	OBJECTIVES	OUTCOMES & METRICS
 <p>Goal 1: Mission Driven & Adaptable to Transformation</p>	<ol style="list-style-type: none"> 1. Engage MDs, TCLs, and Centers to manage and track Agency assets aligned to missions 2. Evaluate and track mission relevance tied to utilization and condition 3. Develop and manage an Integrated Investment Strategy 	<p>Mission Success through Integrated Strategic Management</p>
 <p>Goal 2: Stakeholder Accountability</p>	<ol style="list-style-type: none"> 1. Sustain joint responsibility with MDs for assets 2. Define a governance structure to manage all Agency assets 3. Develop a strong business case for proposed investments 	<p>Effective Governance of Agency-wide Assets</p>
 <p>Goal 3: Affordable Portfolio</p>	<ol style="list-style-type: none"> 1. Fund O&M equitably 2. Strategically consolidate the Agency's footprint 3. Provide sustainment guidance 	<p>Identify and Manage an Affordable Portfolio</p>
 <p>Goal 4: Risk Mitigation</p>	<ol style="list-style-type: none"> 1. Align to the Agency Resilience Plan 2. Integrated Risk Mitigation 3. Align to the Climate Action Plan 	<p>Integrated and Proactive Risk Mitigation Strategy</p>
 <p>Goal 5: Sustainability Best Practices</p>	<ol style="list-style-type: none"> 1. Employ Sustainability Principles 2. Plan for cultural & natural resources 3. Provide enduring and adaptable facilities and infrastructure 	<p>Responsible Resource Stewardship</p>
 <p>Goal 6: Inspire our Workforce</p>	<ol style="list-style-type: none"> 1. Align with the Agency Workforce Plan 2. Align with the Future of Work Plan 3. Improve occupancy tenant satisfaction 4. Create places to recruit & retain talent 	<p>Foster Retention and Recruitment</p>

AMP/AIA Strategy



AMP/AIA Definitions



Divest

- RP assets bucketed as "**Divest**" have low mission and low condition scores and/or assets that do not have a future need should be considered for divestment through demolition.
 - High mission assets should not be identified as divest. If a high mission asset is tied to a renewal project, it should be Invest – New Building or Invest - Renovation.
- RP assets bucketed as "**Invest**" have a high mission score but a low condition score and should be considered for investments to reduce their DM, improve their FCI, and/or improve their overall affordability.



Invest

- **Invest – Repair:** Current state is high mission and low condition. Repair level investments are recommended for the real property asset to ensure mission success.
- **Invest – Renovation:** Current state is high mission and low condition. Full renovation of the real property asset recommended to ensure mission success.
- **Invest – New Building:** Current state high mission and low condition assets where the condition is so poor that investing in the existing building is not feasible (only option is a new building; if we do not build a new building it will impact the mission significantly). A new building to replace the existing building/s is recommended to ensure mission success.
 - If an asset is currently planned to be relocated into a new building and is low mission and low condition it should either be identified as sustain or divest. We cannot assume we will get funding for a renewal/consolidation project.
 - If an asset is going to be abandoned, it should be divest

Resilience Planning

Resilience Drivers

[Executive Order \(EO\) 14057: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability \(2022\)](#)

- Ensure Climate resilient infrastructure and operations

[EO 14008: Tackling the Climate Crisis at Home and Abroad \(2021\)](#)

- **Agency Climate Adaptation and Resilience Plan**
 - Priority 3: Integrate Climate Risks and Risk Analysis and **Agency Resilience Planning**
 - Develop an Agency Resilience Framework and Center Resilience Plans that include Center climate change resilience strategies. The results of resilience planning will serve as input to Center master planning, and operations and maintenance processes.

[Presidential Policy Directive \(PPD\)-21 Critical Infrastructure Security and Resilience \(2013\)](#)

- Implementation of an integration and analysis function for critical infrastructure that includes operational and strategic analysis on incidents, threats, and emerging risks and it shall include the capability to collate, assess, and integrate vulnerability and consequence information with threat streams and hazard information.

[Agency Master Plan](#)

- **Goal 4: Risk Mitigation**
 - Agency Resilience Plan Framework
 - Integrated Risk Mitigation Strategy for Critical assets
 - Align to the Climate Action Plan

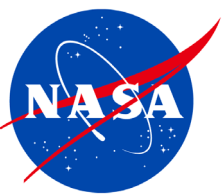
Resilience Assessments

Agency Resilience Framework and Center Resilience Assessments

- Inter-Agency Agreement with DOE/NREL to develop Agency Framework and conduct Center Resilience Assessments
- Partnership with NASA Climate Adaptation Science Investigators (CASI)
- Framework will apply common principles across NASA Operations to identify, assess, prioritize, and protect the Agency's Critical Infrastructure, Mission Essential Functions, and Critical Interdependencies
 - Center Resilience Assessments
 - a) Assess Baseline
 - b) Identify **vulnerabilities** (internal weaknesses)
 - c) Identify **hazards and threats** (external stressors)
 - d) Analyze and score **risks**
 - e) ID and score mitigation options
 - NASA Resilience Framework to be finalized by Spring 2023
 - Center Resilience Assessments completed at JSC (2020) GSFC/WFF (2022), and KSC (2022)
 - GRC to get started in Spring 2023
 - LaRC to be completed in Summer 2023
 - Center Resilience Project Manager
 - JSC/LaRC – Center Master Planner
 - GRC/GSFC/KSC – Center Energy Manager



Resilience Study Findings



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Initial Resilience Study Findings:

- Underground infrastructure at risk of failure
 - Underground infrastructure at risk of failure due to several factors

- Mission-critical facilities located near coastline
 - Mission-critical facilities are located along the ocean coastlines

- Launch reliance on commodity supply chains
 - Commodities required in large volumes are subject to supply chain hazards and threats



Energy Projects

CoF Energy Savings Investments

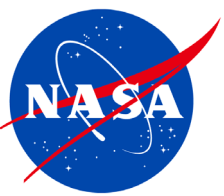
Purpose:

- Focused on improving systems efficiencies and reducing utilities expenditures
 - Support NASA's mission
 - Contribute to NASA fulfilling Federal requirements for energy efficiency and renewable energy
 - Example project scopes

The recent call for Energy Projects emphasized:

- Focus on improving systems efficiencies and reducing utilities expenditures
- Identified potential projects through call for Center proposals for energy efficiency projects in significant energy use facilities that perform NASA operations
- Selected projects to reduce NASA energy/water utilities expenditures and contribute to Federal energy/water requirements
- Prioritized implementing life-cycle cost-effective energy/water conservation measures in specific facilities based on costs and savings estimated in facility comprehensive evaluations (audits) and life-cycle cost analysis
- N/A SIRs not available because projects moved from 2023 to 2024 due to overall CoF budget posture, and SIR calculations began with 2024 new proposals

Energy Projects – Solar PV



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JPL Building 301

- Partnership with:
 - NASA Management Office
 - Clark Energy Group
 - Southern California Edison
- Power:
 - Generates 450 kWh per year
 - 365 tons of CO2 emissions savings
 - Savings of \$60K annually
- System :
 - 300 kW PV system
 - 864 solar modules
 - 8 inverters



Energy Projects – Solar PV



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CoF Solar PV on Parking Structure

JPL Building 301

Scope:

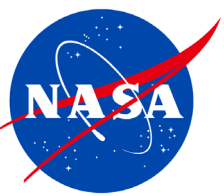
- Design/build carport PV on JPL parking structure
- 0.881 mW system

Projected Savings:

- 1,440,944 kWh/Annually
- \$141,213/yr



Enhanced Use Lease (EUL) Net Revenue

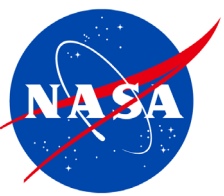


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NASA authority 51 USC 20145

- Lease non-excess but underutilized assets to tenants
- Collect cash consideration at fair market value
 - ❑ Or in-kind consideration for renewable energy production
- Deposit in CECR capital asset account any net revenue beyond expenses of hosting tenants
 - ❑ 65% available to Center that hosted tenant
 - ❑ 35% available to Agency for use at any Center
- Utilize for maintenance, capital revitalization, and improvements of real property assets and related personal property

EUL Funded Projects – Existing Buildings

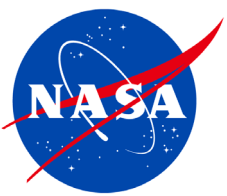


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EUL Notes:

- Several Centers include energy projects in 65%
- Using Agency 35% for energy and sustainability upgrades at various Centers
 - \$30.1M in PY 2008-2022
 - Launched cyclical Existing Building Commissioning (EBCx) Program in FY 2018
 - Center proposals typically due in November based on Center-funded commissioning study reports

Enhance Use Lease (EUL)



Agency 35% EBCx FY2021 and FY2022 Projects

Agency 35% EBCx FY2021 Projects

CENTER	BUILDINGS	AREA	
GSFC	Bldg 21	148,655	
	Bldg 1	79,157	
	Bldg 7	163,578	
	Bldg 11	118,110	
	Bldg 13	84,197	
	Bldg 29	162,667	
	Bldg 10	57,875	
	Bldg 30	67,860	
	JSC	Bldg 12	69,844
	KSC	M6-0791	32,522
LaRC	Bldg 1268	56,981	
MSFC	Bldg 4600	142,883	
SSC	Bldg 2119	8,372	
	Bldg 2120	8,246	
	Bldg 3204	14,238	
		1,215,185	

Agency 35% EBCx FY2022 Projects

CENTER	BUILDINGS	AREA
ARC	Bldg N235	10,850
GRC	Bldg 49	100,703
	Bldg 60	37,440
	Bldg 105	33,823
LaRC	Bldg 1268/A	76,384
MSFC	Bldg 4601	144,617
	Bldg 4250	35,356
SSC	Bldg 3418	3,565
	Bldg 4110	20,303
		463,041

Demolition/Consolidation



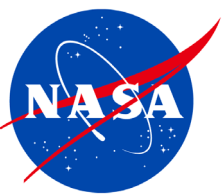
SPOTLIGHT

Demolition Program

FY22:

- Disposed over 700K SF, 45 facilities
- Eliminated over \$20M of Deferred Maintenance
- Avoided over \$5M in Maintenance and Operations costs

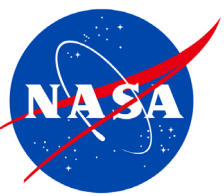
FY2022 Demolition Projects



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FY FUNDED	Center	System or Building Name	Total Gross (SF)
2022	Glenn Research Center	EDWARD R. SHARP EMPLOYEE CENTER (3163)	41,535
2022	Glenn Research Center	BRIEFING CENTER (3156)	17,300
2022	Goddard Space Flight Center	MAIN GATEHOUSE BLDG (4053)	7,237
2022	Johnson Space Center	ENGINE TEST STAND (4256)	
2022	Johnson Space Center	ENGINE TEST STAND (4384)	
2022	Langley Research Center	COMBINED LOADS TESTING FACILITY (9443)	7,184
2022	Langley Research Center	COMBINED LOADS TESTING FACILITY (2358)	8,435
2022	Total		253,420.00

FY2023 Demolition Projects



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FY	Center	System or Building Name	Total Gross (SF)
2023	Johnson Space Center	ENGINE TEST STAND (4256)	0
2023	Marshall Space Flight Center	ELECTRICAL EQUIPMENT BUILDING (2510)	288
2023	Marshall Space Flight Center	TEST FACILITY TERMINAL BUILDING (2682)	5,153
2023	Langley Research Center	FREQUENCY CONVERTER FACILITY (2305)	9,941
2023	Langley Research Center	FREQUENCY CONVERTER FACILITY (2305)	9,941
2023	Langley Research Center	RESEARCH LAB (2243)	85,456
2023	Langley Research Center	PEARL YOUNG CONF CENTER (2244)	16,114
2023	Langley Research Center	1299 RESEARCH COMPLEX (2438)	60,218
2023	Marshall Space Flight Center	PROPULSION & STRUCTURAL TEST FACILITY (2693)	19,304
2023	Glenn Research Center	ANTENNA TEST FACILITY (3155)	24,434
2023	Glenn Research Center	EDWARD R. SHARP EMPLOYEE CENTER (3163)	41,535
2023	Johnson Space Center	VIBRATION AND ACOUSTIC TEST FACILITY (3571)	62,737
	TOTAL		335,121.00

Demolition/Consolidation

CONSOLIDATION –The relocation or combining of one or more functions (people or things) from a NASA-owned building(s) to an underutilized space(s) in another NASA-owned building(s). Consolidation involves the improvement, rehabilitation, reconfiguration, or enhancement of the receiving space(s) and the demolition of the vacated building(s).

- **GOALS:**

- Reduce the Agency's footprint
- Reduce M&O and utility costs
- Promote remote work, telework and hoteling
- Improve the effective use of underutilized space(s)

- **REQUIREMENTS:**

- Demolition of one or more buildings
- Cannot already be on the demolition list
- Cannot be a previously identified offset for a renewal project
- Must be building(s) vacated
- No additional square foot - all renovations within existing space
- No out-grants
- Project scope and cost limited to those normally allowed in CoF (demolition, renovation/repair, design, allowed outfitting, etc.)

FY2022 Demolition Projects



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FY2023 Demolition Projects



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CNET Highlights Watch NASA Demolish Marshall Space Flight Center Building

MORE VIDEOS

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New Construction Projects

Glenn Research Center Research Support Building

- 52,000 sf
- LEED Gold
- GSA Excellence in Design Project



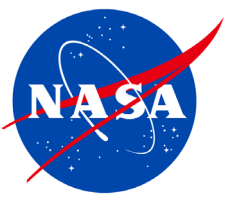
New Construction Projects

Langley Research Center Measurement Systems Laboratory

- 175,000 sf
- LEED Gold
- ENR Mid-Atlantic Government/Public Building of the Year (2022)



New Construction Projects



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Goddard Space Flight Center Instrument Development Facility

- 54,000 sf
- LEED Gold
- Association of Builders and Contractors (ABC) Washington Metro and VA Chapter Excellence in Construction Award



