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National Aeronautics and Space Administration

Headquarters
Washington, DC 20546-0001

March 1, 2021

Reply to attn. of: Office of Communications

Re: NASA FOIA Tracking Number 21-HQ-F-00200

This responds to your Freedom of Information Act (FOIA) request to the National Aeronautics and Space Administration (NASA), dated January 16, 2021, and received in this office on January 19, 2021. You seek:

A copy of the NASA Capital Plan (i.e., Agency-wide Real Property Capital Plan), as required and described in OMB Memorandum M-20-03 issued November 6, 2019, and M-20-03 Implementation Guidance issued July 2, 2020

In response to your request we conducted a search of NASA's Facilities and Real Estate Division. That search identified the enclosed records that are responsive to your request. We determined that all 51 pages are appropriate for release without excision and copies are enclosed.

Appeal

If you believe this to be an adverse determination, you have the right to appeal my action on your request. Your appeal must be received within 90 days of the date of this response. Please send your appeal to:

Administrator
NASA Headquarters
Executive Secretariat
ATTN: FOIA Appeals
MS 9R17
300 E Street S.W.
Washington, DC 2054

Both the envelope and letter of appeal should be clearly marked, "Appeal under the Freedom of Information Act." You must also include a copy of your initial request, the adverse

determination, and any other correspondence with the FOIA office. In order to expedite the appellate process and ensure full consideration of your appeal, your appeal should contain a brief statement of the reasons you believe this initial determination should be reversed. Additional information on submitting an appeal is set forth in the NASA FOIA regulations at 14 C.F.R. § 1206.700.

Assistance and Dispute Resolution Services

If you have any questions, please feel free to contact me at Stephen.g.rowe@nasa.gov. For further assistance and to discuss any aspect of your request you may contact:

Stephanie Fox
Chief FOIA Public Liaison
Freedom of Information Act Office
NASA Headquarters
300 E Street, S.W., 5P32
Washington D.C. 20546
Phone: 202-358-1553
Email: Stephanie.K.Fox@nasa.gov

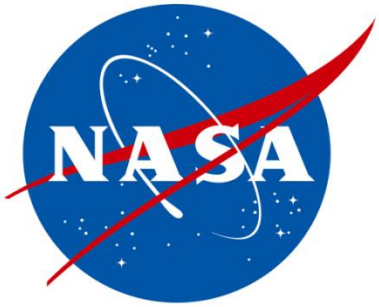
Additionally, you may contact the Office of Government Information Services (OGIS) at the National Archives and Records Administration to inquire about the FOIA mediation services it offers. The contact information for OGIS is as follows: Office of Government Information Services, National Archives and Records Administration, 8601 Adelphi Road-OGIS, College Park, Maryland 20740-6001, e-mail at ogis@nara.gov; telephone at 202-741-5770; toll free at 1-877-684-6448; or facsimile at 202-741-5769.

Important: Please note that contacting any agency official including myself, NASA's Chief FOIA Public Liaison, and/or OGIS is not an alternative to filing an administrative appeal and does not stop the 90 day appeal clock.

Sincerely,

Stephen Rowe

Stephen Rowe
FOIA Public Liaison



National Aeronautics and Space Administration

Real Property Capital Plan

Submitted by the Mission Support Directorate and

Office of Strategic Infrastructure

January 6, 2020

Table of Contents

I. EXECUTIVE SUMMARY

This Real Property Capital Plan (RPCP) has been developed to meet the Government-wide capital planning objective defined in *OMB M-20-03: Agency-wide Real Property Capital Planning (RPCP) Action.* This document captures the National Aeronautics and Space Administration's real property planning process and the current status of that real property. The National Aeronautics and Space Administration (NASA) has a mature and robust capability to plan, prioritize, control, and monitor its capital planning investments, which include recapitalization and maintenance of existing facilities. This RPCP responds to the request by the Federal Real Property Council (FRPC) in accordance with the Federal Property Management Reform Act of 2016 (FPMRA), 40 U.S.C. § 621. NASA concurs fully with the requirement that agencies consistently implement sound capital planning practices to optimize their portfolio in order to cost effectively achieve the Agency's mission. The intent of this RPCP is to:

- document NASA's real property capital planning process.
- demonstrate NASA's approaches to the required internal Agency capital planning actions (i.e., mission requirements, needs assessments, prioritization, alternatives analysis, cost estimates, and performance goal/metric definition).
- capture real property capital planning key data.
- discuss real property management strategies.
- review and provide references to related documentation.
- comply with Program Management Improvement Accountability Act (PMIAA) Portfolio Review Requirements.

Background

NASA's ten Centers primarily manage and execute the mission work—engineering, operations, science, and technology development—and other mission-enabling activities. The NASA workforce, comprising about 17,000[1] civil servants, is distributed among the Agency's Centers, facilities, and Headquarters. NASA stewards 5,456 real property assets ($12.62B Book Value) with a $41.36B Current Replacement Value (CRV). Managing these assets is critical to fulfilling NASA's mission requirements. In stewarding this portfolio, NASA faces several challenges[2]:

- NASA owns most of its portfolio (96 percent, ~5,180 owned assets).
- Unlike other agencies, NASA's portfolio is **not** predominantly composed of office space and storage (20 percent, ~1,019 buildings); its remaining buildings and structures include many large, specific, and unique technical capabilities, along with corresponding

[1] All data refers to 2020 unless stated otherwise.
[2] *NASA's FY 2020-24 Real Property Efficiency Plan, 2019.*

constraints for each type of facility, including processing challenges and hazards, environmental impacts, and historic significance.

- NASA's built portfolio (does not include structures or land) is degrading (~80 percent of the portfolio was constructed before 1980; the average building lifespan is 40 years[3]), with increasing operational and maintenance costs.

- Centers have geographically diverse locations with large-scale infrastructure to support unique and specific research and development needs.

- In addition to the ten Field Centers, NASA also owns and/or manages real property globally on all continents.

Real Property Capital Planning and Prioritization

NASA guides the Agency's facility investments through a comprehensive Planning, Programming, Budgeting, and Execution (PPBE) process, allocating funding across real property activities, including construction/renewal, operations and maintenance (O&M), repair, divestment, leasing, etc. While the Office of Strategic Infrastructure (OSI) receives dedicated funding for facilities activities through its Safety, Security, and Mission Services (SSMS) and Construction and Environmental Compliance and Restoration (CECR) accounts (institutional funds), Mission Directorates also receive O&M, repair, and facility planning and design allocations in their respective budgets (programmatic funds). Capital planning processes apply to facilities-related funds in both institutional and programmatic accounts.

NASA uses evidence to inform investment decisions at all levels, from day-to-day operations to selecting major missions and establishing the necessary infrastructure to pursue goals that may take a generation (or longer) to realize. Evaluations conducted by internal, external, and independent parties help inform strategies and priorities. Through NASA's OSI, the Agency conducts a robust mission-driven master planning process to systematically inform budget requests. NASA's mission-based master planning process is supported by policy,[4] procedural requirements,[5] and the NASA Handbook for Master Planning, which aligns with the Department of Defense's (DoD) *Unified Facilities Criteria (UFC) 2-100-01 Installation Master Planning* document. NASA's master plans link mission requirements and Agency guidance to affordable stewardship of NASA's land, buildings, and other structures. OSI manages several capital initiatives as part of NASA's Construction of Facilities (CoF) Program: Renewal (Recapitalization), Repair, Demolition, and Energy Savings Investments. Each of these initiatives prioritize Agency needs and investments determined through the Agency Master Planning process.

Gaps

Although NASA's facilities and infrastructure are critical to achieving the mission, their collective status is suboptimal in terms of their readiness to support mission requirements into

[3] NASA considers the useful life of highly technical facilities to be approximately 40 years, due to the nature of the work conducted in NASA facilities and the requirement for sophisticated building systems and capabilities.
[4] *NASA Policy Directive (NPD) 8810.2, Master Planning for Real Property*, available on NODIS.
[5] *NASA Procedural Requirements (NPR) 8810.1, Center Master Planning*, also available on NODIS.

the future. NASA's aging real property portfolio has a deferred maintenance backlog that is estimated to be around $2.66 billion or 6.4 percent of the Current Replacement Value (CRV) of Active Facilities, and resulting costs of unscheduled maintenance and repairs are a significant drain on limited resources.[6] Based on its deliberate facilities planning capability, NASA submits a targeted budget within its guideline that strives to sustain facilities maintenance, recapitalization, and the consolidation required to meet NASA's missions. Given the current fiscal climate, NASA continues to present a budget that is sufficient to sustain it in its current state, but does not present a budget that will reinvigorate its portfolio and revitalize facilities to meet NASA needs. Given historical budget trends, absent a significant adjustment to facilities funding, NASA will only be able to achieve an affordable real property portfolio by aggressively shrinking its facilities footprint (and the corresponding O&M costs).

In years where NASA's budget does not reflect the President's Budget Request, projects are typically delayed two years. Delaying renewal/recapitalization leads to increased sustainment costs, since repairs become more costly as the buildings continue to age; in some cases, the repairs are more expensive than capital renewal expenditures would have been. Over time, the Agency's risk posture worsens as facilities become obsolete and the infrastructure is not revitalized at the pace required to support the mission needs. Continued facility system failures such as chiller breakdowns, water main breakages, and transformer fires reflect the unsustainable challenges NASA is encountering.

NASA continues to attempt to remedy funding gaps internally through various initiatives that reduce or eliminate the cost of maintaining its aging infrastructure. NASA's primary strategy is to reduce the Agency's footprint through consolidation and demolition. Other strategies and programs include modernization, enhanced sustainment approaches, digital transformation, sustainability policies, and out-granting, among others that have been harnessed to address the persistent resource gap. Through a comprehensive strategic planning process focused on the facilities needed to support the missions of the Agency, NASA strives to reduce its infrastructure, prioritize its real property-related projects smartly, and drive toward an affordable portfolio.

II. INTRODUCTION

This Real Property Capital Plan (RPCP) was developed by NASA in response to *OMB M-20-03* and presents an overview of existing NASA capital planning practices and processes to demonstrate how they readily fulfill the RPCP requirements mandated by OMB. Most of the required components have been critical parts of NASA's strategic and operational planning for many decades. NASA's mature and robust RPCP practices and processes and their ongoing ability to meet the current OMB requirements are explained by NASA's unique standing with regard to its mission, its extensive real property legacy, and the condition of its facilities. First, given its extraordinary mission, NASA's real property portfolio goes beyond ordinary office space and storage and includes many unique technical facilities (e.g., laboratories, wind tunnels, thermal vacuum chambers and launch complexes) as well as historical sites. This diverse portfolio creates extensive responsibilities and requires special authorities. Second, NASA owns most (96 percent) of its real property portfolio, which is geographically dispersed across the

[6] *NASA's FY 2021 Volume of Integrated Performance*

United States and even across the globe. Third, while stewarding this extensive real property portfolio, NASA is required to find ways to modernize its facilities to accommodate its extremely dynamic mission and the changing requirements for advanced technical and scientific capabilities. Complicating this responsibility, many of NASA's facilities were designed for a different era and are outdated for meeting current mission requirements. With consistently shrinking resources, NASA often needs to make painful but well-justified real property decisions.

As a result of these unique conditions, and special authorities afforded by Congress (i.e., authorities to acquire, construct, improve, repair, operate, and maintain laboratories and research and testing sites and facilities; to lease to others such real and personal property; and to sell and otherwise dispose of real and personal property), NASA carefully considers real property needs and gaps on a continuous basis. Operating in a limited resource environment and tasked to address these difficult real property considerations, NASA is accustomed to working hard to rigorously and consistently define mission requirements for real property, conduct needs assessment, perform alternatives analysis, prioritize identified gaps, develop realistic cost estimates, and track performance goals/metrics. To this end, NASA has implemented a rigorous, Agency-wide, information collection and analysis practice to inform and enable a consistent and robust real property planning process that spans decades. Figure 1 presents an overview of the current NASA real property planning cycle and sets the stage for the rest of this RPCP document.

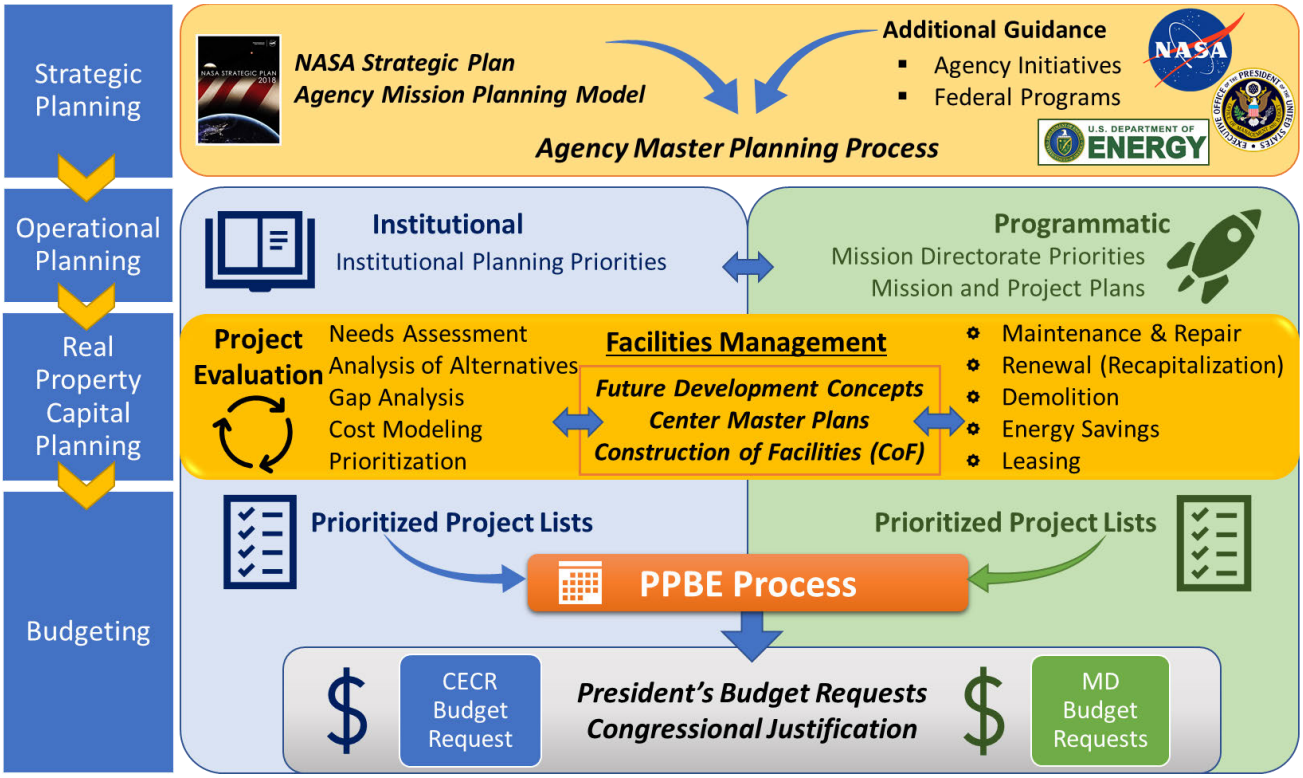


Figure 1. Overview of NASA's Real Property Capital Planning and Budgeting Processes

NASA's real property capital planning starts with strategic-level planning and guidance. The *NASA Strategic Plan* and the *Agency Mission Planning Manifest*, combined with guidance provided via Agency initiatives and other Federal agencies (e.g., Department of Energy's guidance on Federal energy requirements, OMB's *Reduce the Footprint* program), are used to structure an Agency Master Plan (AMP) for facilities and infrastructure. The strategic planning process, consistent with OMB Circular A-11, should anticipate changes in the Agency's requirement for technological capabilities, identify major assets that are critical to implement the plan, and define the outcomes these assets will help realize. NASA also strives to ensure its strategic plan is consistent with the level of future budgetary resources that will be available.

Previously, NASA's real property planning and related decisions largely relied on disparate assessments conducted by its ten Centers. Although this strategy allowed for innovation through cross-Center competition for missions, it also resulted at times in an unnecessary duplication of capabilities as well as inefficient management of NASA's assets. Recognizing the need for a different approach in a more resource-constrained era, the Agency is shifting toward increasingly centralized management of its real property and capabilities portfolio, while maintaining Centers as key actors in the management process. Reflecting this transition, NASA reimagined the AMP as an ongoing, participatory process (rather than a discrete, final plan) that facilitates synthesis of diverse stakeholder perspectives and allows them to function more effectively as an Integrated Project Team.

In line with this new vision and the associated changes, NASA has incorporated into its planning practices an Agency master planning process that represents an iterative, integrated and Agency-wide reflection process that facilitates coordination by and participation of a diverse set of NASA stakeholders in real property-related decision-making. This synthesized view allows capital assets to be more effectively compared against one another to create a prioritized portfolio of the Agency's major capital assets. The comprehensive strategic guidance captured in the AMP is then converted into operational planning in two distinct but coordinated arenas: institutional planning that determines Center- and Agency-focused priorities, as well as programmatic planning that determines Mission Directorate (MD) priorities and develops mission and project plans. Based on these detailed operational planning approaches, institutional and programmatic priorities are fed into a robust real property capital planning process to evaluate projects, determine costs, and identify priorities based on key factors.

NASA's real property capital planning structure applies iterative analytic evaluation processes, such as needs assessments, analysis of alternatives, cost modeling, gap analysis, and prioritization to develop well-supported and coordinated Future Development Concepts (FDCs) and CMPs. Defined facilities programs (e.g., maintenance, repair[7], renewal (recapitalization), demolition, energy savings investments, and leasing) also leverage these project evaluation processes to determine priorities and associated costs, contributing to NASA's prioritized project lists, capturing the most pressing and important needs from both the institutional and programmatic planning sides of NASA's real property portfolio. These project lists are coordinated and deconflicted during the PPBE process, culminating in NASA's inputs to the

[7] Sustainment includes both maintenance and repair, which NASA manages separately. NASA uses the term "renewal" to refer to recapitalization. For the purposes of this document, those two terms are considered interchangeable.

yearly President's Budget Requests and corresponding Congressional Justifications. Institutional operations and maintenance priorities are represented in the Agency's Safety, Security, and Mission Services (SSMS) Infrastructure and Technical Capabilities (I&TC) program) portions of the NASA budget estimate and Programmatic O&M requirements are part of each relevant MD's budget request. Both Institutional and Programmatic construction and large repair requirements are represented in the CECR.

While this graphic depicts, at a high level, the role each NASA practice and process plays within the overall Agency's RPCP strategy, in the following section we will provide more detailed information on specific activities and processes and the ways in which they readily fulfill the RPCP requirements mandated by OMB in *M-20-03*.

III. CAPITAL PLAN

1. NASA's Mission & Requirements

For six decades, NASA has led the peaceful exploration of space, advancing knowledge of Earth, while making discoveries about the furthest reaches of the universe. NASA research has advanced aeronautics, helped develop the commercial space industry, and strengthened the U.S. economy. This unique mission, respective requirements, and NASA's extensive supporting real property portfolio are sustained by NASA's talented workforce of more than 17,000[8] professionals coming from many diverse backgrounds and united by a common purpose. *NASA 2018 Strategic Plan* establishes a foundation for broader context of the Agency mission, linking mission elements and priorities to physical infrastructure requirements.[9]

Agency Strategic Plan

2018 NASA Strategic Plan defines NASA's vision and mission as follows:

NASA's Vision

To discover and expand knowledge for the benefit of humanity.

NASA's Mission

Lead an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system and bring new knowledge and opportunities back to Earth. Support growth of the Nation's economy in space and aeronautics, increase understanding of the universe and our place in it, work with industry to improve America's aerospace technologies, and advance American leadership.

In light of this mission and vision, the *Strategic Plan* outlines NASA's plans for the future, provides a clear and unified direction for all of its activities, and sets the foundation on

[8] *NASA Web site, Diversity and Equal Opportunity – Workforce data, 2020.*

[9] NASA's Annual Performance Plan and Annual Performance Report provide this program project information in accordance with Government Performance and Results Act Modernization Act of 2010 (GPRAMA) and in conjunction with the President's Budget Request. They are published together in NASA's annual Volume of Integrated Performance.

which the Agency can build and measure the success of its programs and projects. The *NASA 2018 Strategic Plan* identifies four strategic themes (Figure 2). Three of the themes, *Discover, Explore,* and *Develop,* correspond directly to NASA's missions, while the fourth strategic theme, *Enable*, also provides specific direction to optimize capabilities and operations including sustaining infrastructure capabilities and operations. The *Enable* theme aims to "steward resources by reducing costs, revitalizing capabilities, integrating capabilities across NASA Centers and Mission Support areas, and optimizing operations."

Under the *Enable* theme, NASA has developed six strategic objectives:

- Strategic Objective 4.1: Engage in partnership strategies.
- Strategic Objective 4.2: Enable space access and services.
- Strategic Objective 4.3: Assure safety and mission success.
- Strategic Objective 4.4: Manage human capital.
- Strategic Objective 4.5: Ensure enterprise protection.
- Strategic Objective 4.6: Sustain infrastructure capabilities and operations.

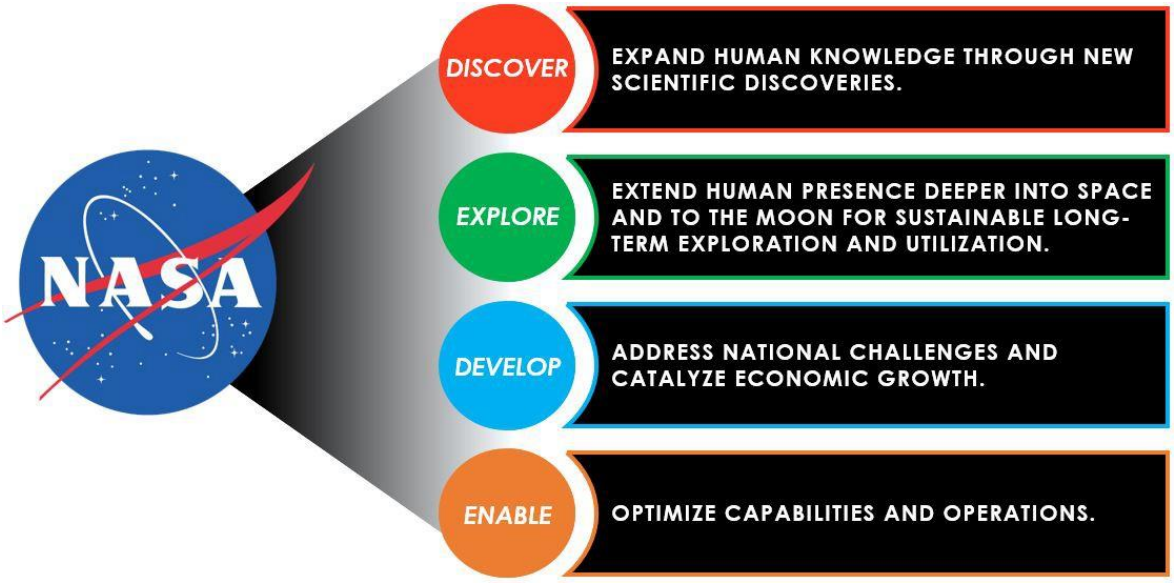


Figure 2. NASA has identified four strategic goals that will strengthen our ability to accomplish our Mission and contribute to U.S. pre-eminence in space exploration, science, technology development, and aeronautics—all to the benefit of the American economy.

Strategic Objective 4.6 serves as the primary guide for management of NASA's real property. Relevant performance goals and metrics tied to Objective 4.6 are reviewed in Section III, Part 6 of this document. In support of these strategic objectives, the Agency works toward the goal that "NASA will renew and modernize its facilities to sustain its

capabilities and to accommodate those capabilities in the most efficient facilities set practical."[10] Through the master planning process detailed in this document, NASA ties its real property capital planning to the support and sustainment of NASA's strategic objectives and missions. Master Planning Goals are also reviewed in Section III, Part 6.

NASA's Real Property Portfolio

NASA's work and workforce are distributed among its ten Centers, its Headquarters building, and other facilities and sites, including several stations overseas. Spread out from coast to coast, NASA's Centers and facilities (Figure 3) are as diverse and specialized as their mission assignments. Directors and staff at these locations manage and execute the majority of the mission work—engineering, operations, science, and technology development—as well as mission-enabling activities. Combined, NASA stewards $41.36 billion (current replacement value) in real property assets, including 5,456 buildings/structures.[11]

Figure 3. NASA's Centers & Facilities

[10] *NASA Facilities and Infrastructure Plan, 2020.*
[11] *NASA's FY 2021 Volume of Integrated Performance.*

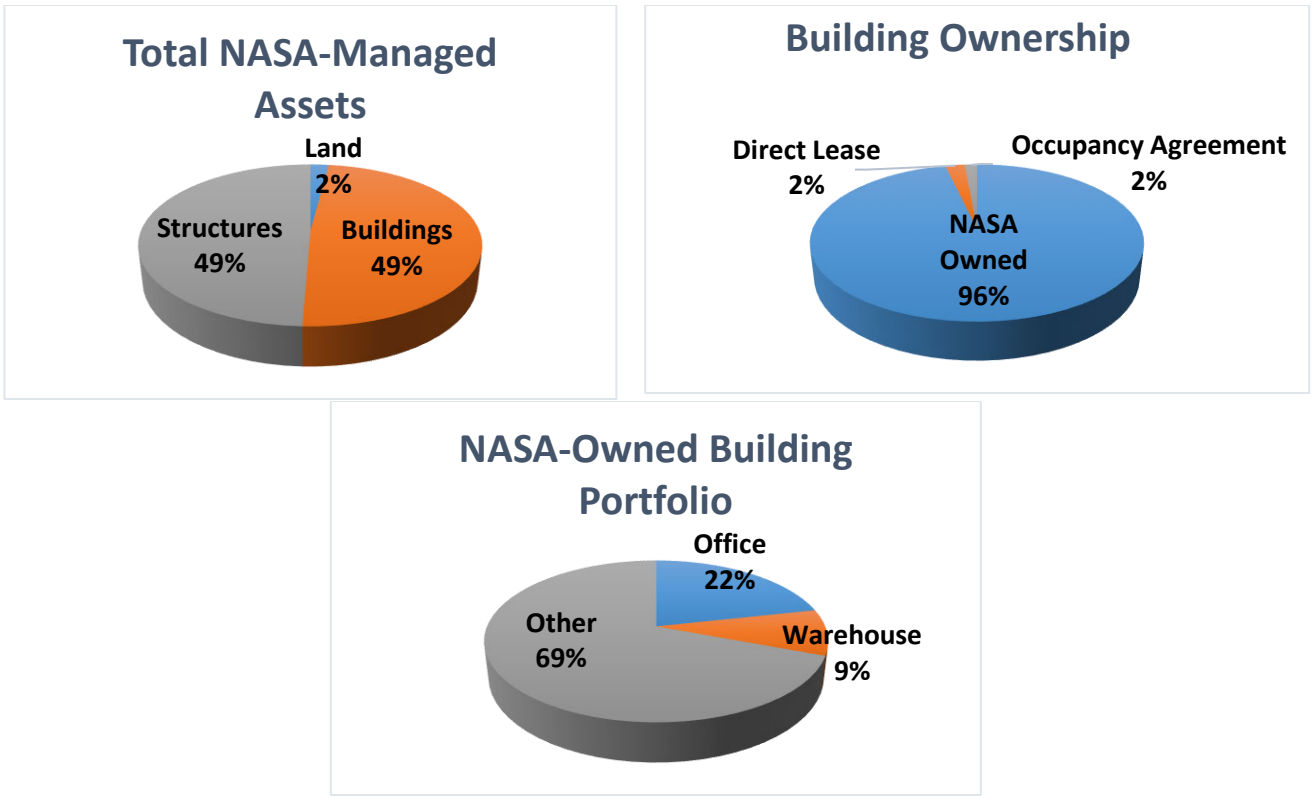


Figure 4. Types of Real Property Managed by NASA[12]

Managing NASA's real property assets is critical to the success of its goals for human space exploration, Earth and space science research, aeronautics research, and developing transformative space technologies to enable future missions. However, NASA's real property management activities have to consider unique conditions. NASA's diverse real property portfolio includes, in addition to standard office and storage spaces, a number of unique technical assets, such as wind tunnels (arc jets), thermal vacuum chambers, test stands, payload processing, rocket assembly, launch complexes, and laboratories (Figure 4). Additionally, Congress mandates NASA to allow commercial interest access to underutilized unique technical assets as part of its mission to work with industry and support the growth of America's space and aeronautics economy.[13]

2. Major Lines of Business

NASA maintains several lines of business consistent with its strategic themes of *Discover*, *Explore*, *Develop*, and *Enable*. The lines of business reflected in the FY2021 Budget Estimates[14] for NASA's Congressional justification include:

- Deep Space Exploration Systems
  - Exploration Systems Development
  - Exploration Technology

[12] Supporting data can be found in Appendix B.
[13] *NASA's FY 2020-24 Real Property Efficiency Plan, 2019.*
[14] FY2021 Budget Estimates https://www.nasa.gov/sites/default/files/atoms/files/fy_2021_budget_book_508.pdf.

- Low Earth Orbit and Spaceflight Operations
    - International Space Station
    - Space Transportation
    - Space and Flight Support
    - Commercial Low Earth Orbit Development
- Science
    - Earth Science
    - Planetary Science
    - James Webb Space Telescope
    - Astrophysics
    - Heliophysics
- Aeronautics
- STEM Engagement
- Safety, Security, and Mission Services
    - Mission Services & Capabilities
    - Engineering, Safety, & Operations
- Construction and Environmental Compliance and Restoration
    - Construction of Facilities
    - Environmental Compliance and Restoration
- Inspector General

To support these lines of business, NASA is organized into: four MDs, a Mission Support Directorate (MSD), an Office of Inspector General (OIG), and the Administrator's Offices. The MDs work collaboratively with NASA's Centers, facilities, and Headquarters to conduct activities aligned with NASA's major lines of business.[15] The MSD performs an enabling function, facilitating work of all MDs. The OIG conducts objective oversight of NASA programs and operations while the Administrator's Offices represent the Administrator and provide guidance and direction across the Agency. The overview and specific function of each is discussed in more detail below.

Aeronautics Research Mission Directorate (ARMD): ARMD designs, develops, and tests advanced technologies that will make aviation much more environmentally friendly, maintain safety, and ultimately transform the way we fly. Research conducted by ARMD directly benefits today's air transportation system, the aviation industry, and the passengers and businesses who rely on aviation every day.

Human Exploration and Operations Mission Directorate (HEOMD): HEOMD leads and manages NASA space operations related to human exploration in and beyond low Earth orbit. HEOMD oversees requirements development, policy, and programmatic oversight across its numerous programs. HEOMD's activities include the International Space Station (ISS), commercial space transportation, low Earth orbit spaceflight operations, deep space exploration systems, launch services, and space communications.

[15] *NASA's FY 2021 Volume of Integrated Performance.*

Science Mission Directorate (SMD): SMD conducts scientific exploration enabled by observatories that view Earth from space, observe and visit other bodies in the solar system, and gaze out into the galaxy and beyond. NASA's science programs focus on three interdisciplinary objectives: discovering the secrets of the universe, searching for life in the solar system and beyond, and safeguarding and improving life on Earth.

Space Technology Mission Directorate (STMD): STMD invests in transformational technologies that may offset future mission risk, reduce cost, and advance capabilities that enable exploration. STMD has used merit-based competition to identify and promote research and technology development, demonstrate applicability, and infuse these technologies into NASA's exploration missions.

Mission Support Directorate (MSD): MSD enables the Agency's missions by managing institutional services and capabilities. MSD is actively reducing institutional risk to NASA's current and future missions by improving processes, stimulating efficiency, and providing consistency and uniformity across institutional standards and practices.

Governance Structure

NASA controls all strategic management processes through its governance structure, which consists of the following Agency-level management councils (Figure 5): [16]

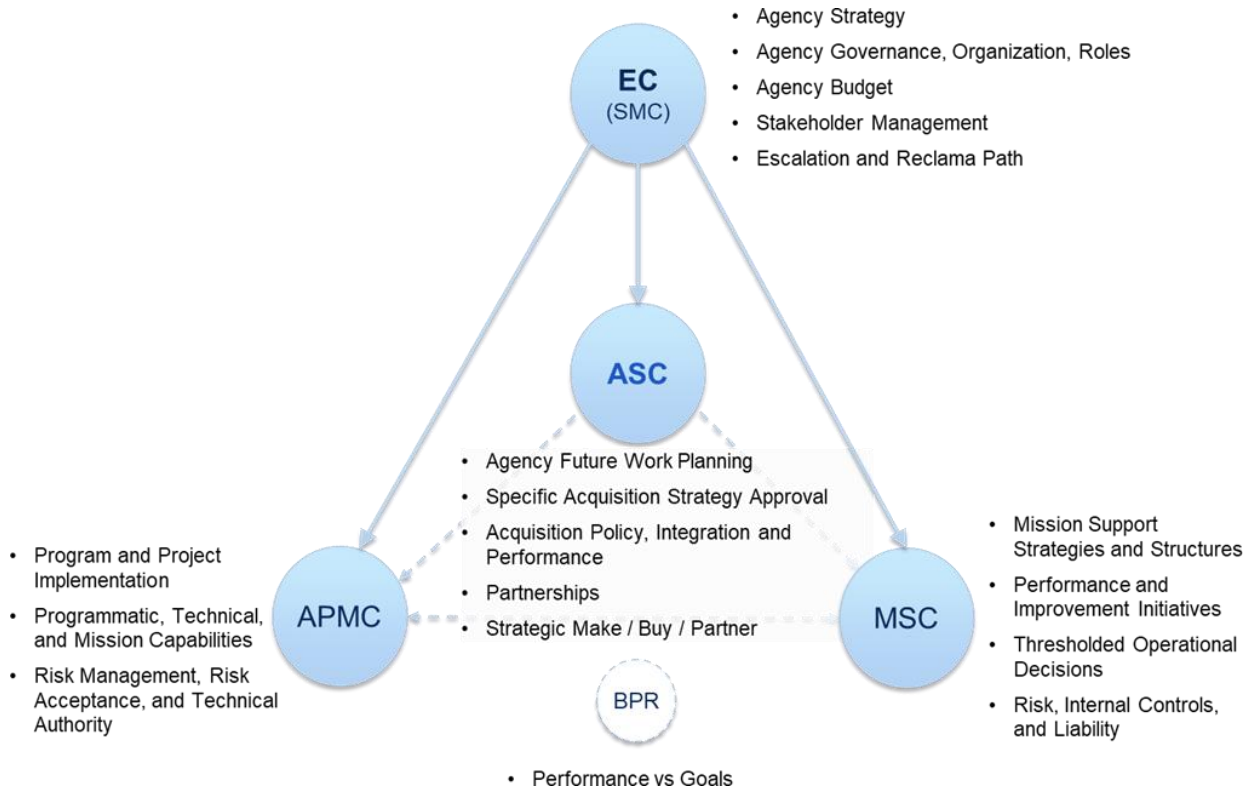


Figure 5. NASA's Governance Structure

[16] *NPD 1000.0C, NASA Governance and Strategic Management Handbook* N_PD_1000_000C_.pdf (nasa.gov)

The Executive Council (EC) determines NASA's strategic direction, assesses Agency progress toward achieving the NASA Vision, and serves as the Agency's senior decision-making body for Agency-wide decisions. For topics dealing with Agency strategic direction and planning, the EC Chair may call a meeting of the Senior Management Council (SMC), which acts in the "extended EC" mode. The SMC provides oversight in planning and evaluating all current mission, operational, and engineering activities in the Agency. Members of both councils advise the Administrator in the Administrator's capacity as Council Chair and decision authority.

The Agency Program Management Council (APMC) serves as the Agency's senior decision-making body regarding the integrated Agency mission portfolio. Chaired by the Associate Administrator, the APMC baselines and assesses performance of NASA projects, programs, mission directorate portfolios, and the integrated Agency portfolio to ensure achievement of NASA strategic goals.

The Mission Support Council (MSC) serves as the Agency's senior decision-making body regarding the integrated Agency mission support portfolio and mission support plans and implementation strategies (including facility, infrastructure, workforce, and associated investments). Chaired by the Deputy Associate Administrator, the MSC determines and assesses mission support requirements to enable successful accomplishment of the Agency's missions.

In addition to the governing councils, the Administrator may convene NASA senior leadership for advice on key issues and strategy through the Senior Management Council (SMC) and other non-governing bodies established under NPD 1000.3. For example, while not a council, the widely attended Baseline Performance Review (BPR) monthly meeting is integral to councils' productivity. The BPR is a monthly internal assessment and reporting forum that tracks performance against Agency plans.

3. NASA Real Property Capital Planning Roles & Responsibilities

Several NASA organizations take part in the real property planning process, performing a range of related functions and acting as an Integrated Project Team. An overview of these organizations and their specific responsibilities are described below:

Office of Strategic Infrastructure (OSI)

NASA Headquarters' OSI is within the MSD and has overall responsibility for policies and oversight of real property management and collaboration with NASA Centers responsible for implementation. OSI ensures that NASA Centers adhere to the current facility strategy that states, "NASA will renew and modernize its facilities to sustain its capabilities, and accommodate those capabilities in the most efficient facilities set practical." OSI is ensuring that NASA facilities will fit the needs of tomorrow's missions and is responsible for developing and managing both the Agency's Master Plan (AMP) and the Agency's Real Property Capital Plan (RPCP). [17]

[17] *NASA's FY 2021 Volume of Integrated Performance.*

Facilities and Real Estate Division (FRED)
The FRED within OSI provides functional leadership for all Agency facility engineering programs, including master-planning, facility planning, design, construction, operations, maintenance, real estate management, real estate agreements, disposal, energy management, and utility management. FRED is also responsible for the sustainment of NASA's facilities through its Agency maintenance strategy and manages NASA's Construction of Facilities (CoF) program. The division provides oversight and consulting on the development and execution of partnering and leasing agreements that leverage NASA's real estate.[18]

Senior Real Property Officer (SRPO)
Consistent with OMB guidance, NASA has designated OSI's Assistant Administrator as the SRPO, tasked with leading and directing the Agency's real property program and implementing real property functions. The designated SRPO represents NASA on the Federal Real Property Council (FRPC), and develops and implements an Agency asset management planning process that meets the form, content, and other requirements established by the FRPC Section 4 of Executive Order 13327—*Federal Real Property Asset Management*.[19]

Office of the Chief Financial Officer (OCFO)
The NASA OCFO manages the annual budget formulation cycle on behalf of the Agency. Additional responsibilities include: development of the Strategic Planning Guidance (SPG), preparation of informational and decisional packages for the Senior Management Council and Executive Council, evaluation of the basis of estimate for budget submissions, assessment of the alignment of budget submissions with the Strategic Plan and policy direction, evaluation of any key gaps or risks associated with submitted budgets, and identification of budget trades. The OCFO also guides the current year's Strategic Review and develops the Annual Performance Plan. Throughout the PPBE process, the OCFO may work with the Cost Account Manager to conduct sensitivity analyses outside the scope of the current baseline to assess the associated disconnects between requested and appropriated funding and inform leadership. [20]

NASA Centers and Facilities
Center Directors are the primary managers of the facilities under their control, and as such are key partners in managing NASA's real property. With guidance and input from the Agency and MDs, they develop the O&M Plans, FDCs, Center Master Plans (CMP), Capital Improvements Program Plans (CIPP), and other supporting documents that contribute to NASA's capital planning process. They also perform supporting analyses (e.g., trade studies, business cases and Economic Analysis Package (ECONPACK)) in support of planning, budgeting, prioritization, and execution to ensure that NASA is a responsible steward of its facilities.

[18] https://www.nasa.gov/offices/FRED.
[19] https://www.govinfo.gov/content/pkg/FR-2004-02-06/pdf/04-2773.pdf and NPR 8800.15C.
[20] *PPBE21 Strategic Programming Guidance (SPG).*

***Mission Directorates* (MDs)**
The MDs are a critical link between NASA's strategic plan and its facilities and infrastructure development. They work with the Agency and Centers to forecast mission needs and integrate requirements into the Centers' infrastructure plans. MDs provide inputs to the AMP and also review FDCs and CMPs during the approval process.

4. Real Property Management and Budgeting

NASA follows a systematic approach to its real property management infrastructure in line with the Capital Planning Guide (OMB Circular A-11) directive to: "(1) establish a baseline inventory of existing capital assets; (2) analyze and recommend alternative solutions; (3) manage the acquisition if approved; and (4) manage the asset once in use." A comprehensive master planning process guides all real property investment, divestment, and sustainment decisions in line with the identified Agency strategic goals and objectives. An annual budgeting process tied to this master planning process and regularly coordinated with OMB aligns limited resources with maintenance, repair, renewal, and acquisitions required for NASA's capital asset portfolio.

Portfolio Inventory
In accordance with FRPC guidance, NASA tracks its real property assets in its Integrated Enterprise Management Program (IEMP) database (currently run by SAP). The Real Property Management System (RPMS), a module of the IEMP, is the primary tool NASA uses to track and manage real property assets including asset-related data, such as condition, costs, and occupancy.[21] The Agency uses the NASA Environmental Tracking System and Energy-Star Portfolio Manager to track data for energy usage and environmental planning. One key objective for RPMS is to more easily tie NASA's assets to mission requirements. This objective is currently promoted and coordinated by OSI through the Agency's master planning process. The near-term intent is to update RPMS and associated databases to enable the required level of fidelity in NASA's inventory management system.

Master Planning Process
NASA conducts a robust master planning process to guide all real property investment, divestment, and sustainment decisions across the Agency (Figure 6). This process is informed by the Agency's mission requirements and is supported by policy,[22] procedural requirements,[23] and the *NASA Handbook for Master Planning.*[24] NASA master planning process includes Agency and Center-level capital plan documents, which are described in greater detail below.

Agency Master Plan. As explained in the *Introduction* section, NASA has recently moved away from its Center-based asset management toward more centralized management of its real property portfolio and related capabilities, while maintaining opportunities for input by Centers and other real property stakeholders. As a result of this shift, the Agency reinvented

[21] *NASA's FY 2020-24 Real Property Efficiency Plan, 2019.*
[22] *NPD 8810.2, Master Planning for Real Property*, available on NODIS.
[23] *NPR 8810.1, Center Master Planning*, also available on NODIS.
[24] https://www.hq nasa.gov/office/codej/codejx/Assets/Docs/2015/NASA_HandbookForMasterPlanning-2_TAGGED.pdf

its AMP to serve as an ongoing, participatory process that facilitates an Agency-wide vision for the future of its facilities while guiding development of the individual 20-year CMPs. This approach provides a forum for integrating disparate guidance and stakeholders into a systematic planning process. The AMP identifies and integrates key strategic planning inputs for CMPs, incorporating guidance from the annual Agency Strategic Implementation Plan (ASIP), Strategic Plan, the Agency Mission Planning Model, Mission Directorate strategic plans, the workforce strategic plan, and Agency information technology strategic plans.

This approach enables an integrated approach to managing NASA's infrastructure portfolio, which includes both mission-critical and mission-supporting assets. The AMP process drives a strategic view from the top (technical mission) down, ensuring mission linkage down to each facility in the Agency followed by a corresponding operational look from the bottom-up, allowing Centers to identify local needs and gaps, in view of mission requirements. This integrated portfolio informs the Agency AMP governance, which strives to sustain its critical assets, improve the condition of its high mission-dependent assets, out-grant some assets, and divest of assets that are not needed for the mission or are beyond their useful life.

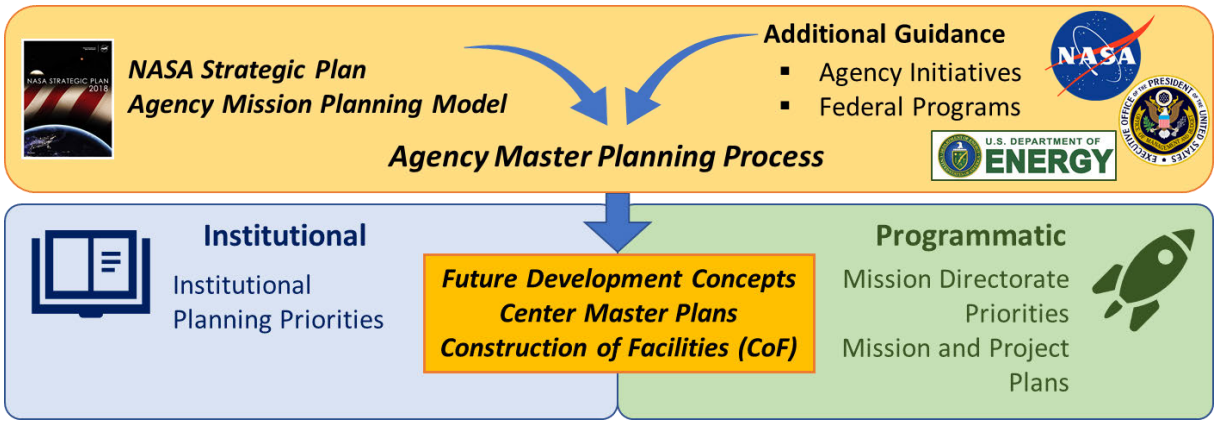


Figure 6. NASA's master planning process converts strategic plans and guidance into an Agency Master Plan. These documents and processes, along with Institutional and Programmatic priorities, help Centers develop their master plans, and guides Construction of Facilities decision making.

Center Master Plans. The CMPs and the AMP link the stewardship of NASA's land, buildings, and other structures with Agency strategic plans to systematically inform budget requests. Each Center uses the Agency and MD guidance to develop Future Development Concepts (FDCs). Once approved, FDCs are used as the framework for 20-year CPMs. Agency policy requires that CMPs are reassessed annually and updated at a minimum every five years—sooner if the following circumstances present themselves:

a) a change in the Agency Facilities Strategy.

b) a significant change in the Center's mission assignments.

c) advances in technology that change facilities requirements.

d) significant changes occurring in the surrounding community.

e) funding levels vary significantly from Agency planning guidance.

Center Master Plans are approved through the MSC at NASA Headquarters. To support this activity, NASA has procured Agency-level master planning contract vehicles that all Centers must use for master planning. This contract vehicle enables Centers to be consistent with Agency policies and ensure alignment with Installation Master Planning Unified Facilities Criteria (UFC) 2-100-01. Successful implementation of the Agency's master planning process enables effective prioritization and budgeting for NASA capital planning. After a thorough, real capital property planning process (to be reviewed in Part 5: Real Property Capital Planning Programs, Processes, and Prioritization), the resulting prioritized project lists are used to inform budget requests.

Budget Process

NASA's annual PPBE process ensures that resource alignment (for facilities as for other expenditures) supports the accomplishment of Agency strategic goals and objectives in a resource-constrained environment (Figure 7).

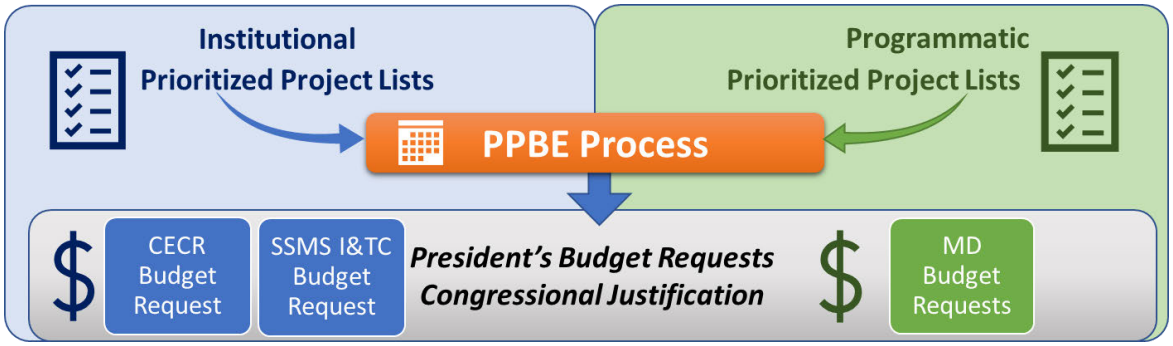


Figure 7. Prioritized project lists are used to inform the PPBE process and subsequent budget requests.

The PPBE process includes developing the Agency Strategic Goals and performance plans, formulating the annual budget, developing fully executable Agency operating and execution plans, and continuing through the years of execution. While OSI receives dedicated funding for facilities activities through the Infrastructure and Technical Capabilities (I&TC) program under its Safety, Security, and Mission Services (SSMS) account and the Construction and Environmental Compliance and Restoration (CECR) account (institutional funds), MDs also receive O&M, repair, and facility planning and design allocations in their respective budgets (programmatic funds). Capital planning processes apply to facilities-related funds in both institutional and programmatic accounts, though they may use distinct mechanisms as appropriate.

NASA guides facilities investments through the PPBE process, allocating funding across real property activities, including construction/renewal, maintenance, operations, divestment and leasing. Major construction, demolition, energy savings investments, and facility planning/design are coordinated within OSI's CoF program. In addition to ensuring alignment with the AMP, FRED ensures that the facilities critical to achieving NASA's mission programs are the right size and type, in sound repair, safe and secure, and

environmentally sound. It also ensures that NASA Centers conform to requirements and initiatives that are in place for the protection of the environment and human health.

Construction of NASA facilities must be funded from NASA's CECR appropriation account. MDs and programs must identify any facilities construction (new, improvement, addition, alteration, or major repair) with a construction budget of over $1 million. The identification of these facilities should be consistent with the Center Roles, as documented in NASA Policy Directive (NPD) 1000.3, and current approved Center Master Plans. For MD requirements, the programs must identify funding for the project from within their program. Funding is transferred into the CECR account during budget formulation from the MD's guideline from the particular program that requires the construction project, thereby contributing to the overall CECR budget for the given fiscal year. All construction projects must be business case analysis compliant with OMB Circular A-11 and must be consistent with current approved CMPs or, for those Centers without updated CMPs, with an approved FDC approved in FY 2018 or later. Detailed guidance for project submissions is included in the Mission Support Program and Resource Guidance.[25] Funding for O&M is accounted for in the I&TC portion of the SSMS budget and is formulated using a sustainment cost model and input from Centers provided through the Program Resource Guidance (PRG). Centers submit their operational budget requests to OSI and budget is allocated according to the guideline for the I&TC account provided by the Agency.

5. Real Property Capital Planning Programs, Processes, and Prioritization

NASA maintains multiple investment programs (Figure 8) to ensure that the Agency budget accounts for a holistic view of its facilities portfolio. Many of the real property capital programs have parallel tracks and processes for institutional (Agency and Center priorities) and programmatic (MD and mission/program/project priorities) considerations. These programs are iterative, informing the annual budgeting process as well as the execution of projects based on the respective budget allocations. Each program integrates needs assessments, analyses of alternatives, business case analyses, cost modeling, and gap analyses into its final prioritization, ensuring decisions are informed by the best possible data and analysis.

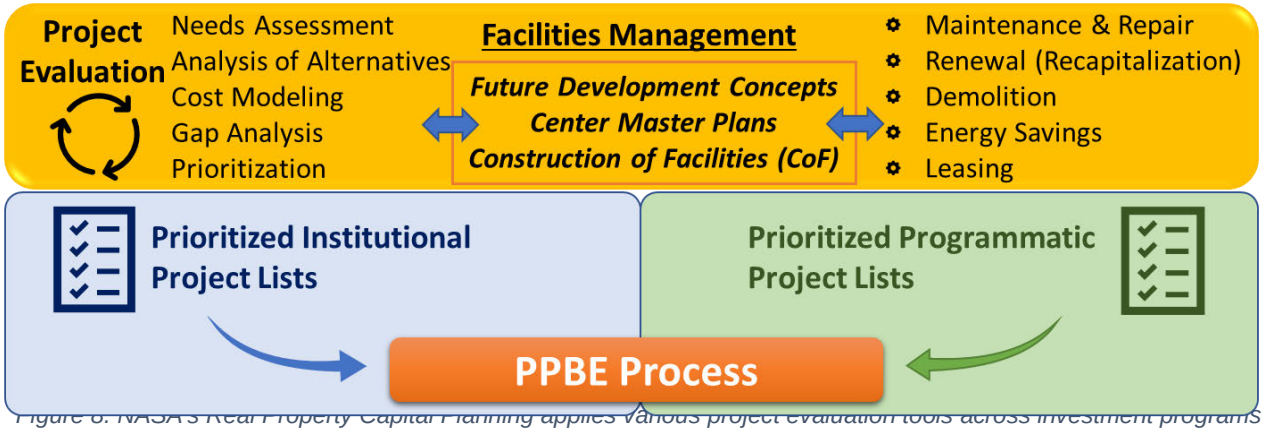


Figure 8: NASA's Real Property Capital Planning applies various project evaluation tools across investment programs to identify and prioritize projects for PPBE.

[25] *PPBE21 Strategic Programming Guidance (SPG).*

Capital Investment Programs

NASA's acquisition and divestment decisions are shaped by a number of investment programs, which are intended to sustain, renew, and modernize its real property and also achieve a more affordable facilities portfolio.[26]

Institutional Renewal (Recapitalization) Program: The overarching objective of the CoF Renewal Program is to renew those real property assets in the Agency inventory that are beyond their service life in order to maintain operational capability.

Institutional Repair (Sustainment) Program*:* The overarching objective of the Repair Program is to restore Agency-owned facilities and components to their originally intended condition, capacity, efficiency, or capability. Specific repair projects are one-time facility work to restore a facility sub-system, component, or collateral equipment that has failed, has a history of failure, or is about to fail.

Programmatic CoF and Repair: Programmatic CoF covers major repairs/modifications as well as construction of additional capacity/capability to existing real property assets that are required specifically for the execution of MD programs and/or projects. Programmatic CoF also covers new construction and demolition that are outside of the scope of repair. Each MD conducts their own approval processes and establishes timelines for determining which OMB Circular A-11-compliant CoF projects will be implemented in any given year. OSI/FRED monitors this process, using standard documentation requirements to make sure they clearly understand the intent of the projects and to ensure all projects comply with all applicable Agency and Federal policies.

Demolition Program**:** The overarching objective of the NASA Demolition Program is to "eliminate inactive obsolete facilities that are no longer required for NASA's missions" and to allow the "Agency to avoid non-productive operating costs required to keep abandoned facilities safe and secure." The 5-year Demolition Plan is also the primary disposal strategy for how the Agency meets the requirements of *OMB Memorandum M-12-12 Section 3: Reduce the Footprint*, which directs agencies to "move aggressively to dispose of surplus properties held by the Federal Government, make more efficient use of the Government's real property assets, and reduce the total square footage of their domestic office and warehouse inventory…."

Energy Savings Investments Program: The overarching objective of the Energy Savings Investments Program is to implement energy projects focused on improving systems efficiencies and reducing utilities expenditures. The energy savings projects that compose this program are of the highest priority based on expected return on investment or contribution to Federal energy mandates.

Leasing Program: In accordance with the 51 USC §20113 and §20145, NASA is authorized to out-lease underutilized NASA-held real property. Title 51 also authorizes NASA to enter into other agreements with external entities, both private and public, to

[26] *NASA's FY 2020-24 Real Property Efficiency Plan, 2019.*

address underutilized real property. Similarly, 54 USC §306121 authorizes NASA to lease Agency historic real properties via the National Historic Preservation Act (NHPA). NASA's authorities allow the Agency to commit to collaborative endeavors that may include the use of NASA facilities and land by other entities during the terms of the agreement. This provides the Agency a unique opportunity to preserve specialized, expensive, and historic assets that are not currently utilized or required by NASA's mission and retain the lease proceeds for use on other NASA infrastructure needs. NASA can also use an in-grant of real property from another Federal entity when required. FRED is responsible for coordinating the review and approval of the in-grant with all appropriate NASA Headquarters organizations.

Investment Program Prioritization Processes

NASA's facilities investment planning process begins several years or more before the start of the PPBE cycle. Documents and sources such as the Decadal Survey, the AMPM, mission programs, and condition assessments inform investment decisions for establishing the necessary infrastructure to pursue respective goals and objectives that may take a generation (or longer) to realize. These sources help inform research strategies and priorities and determine if the Agency has accomplished what it set out to do.[27]

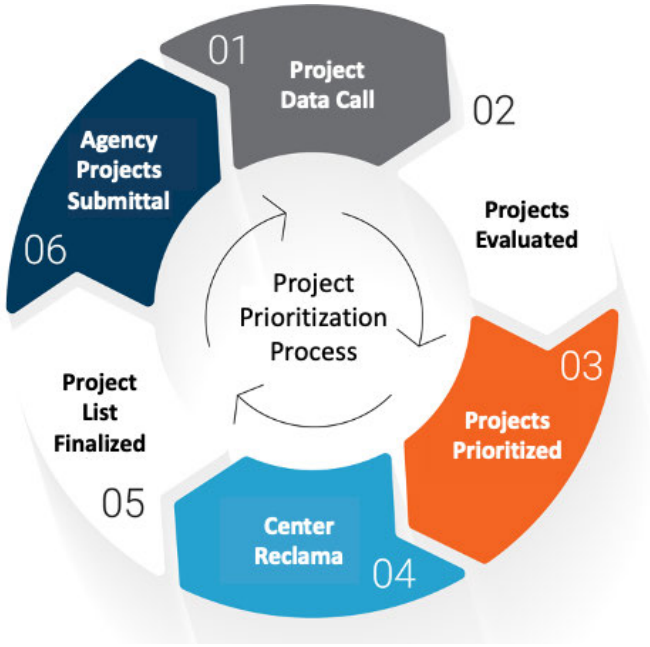


Figure 9. NASA's real property investment programs apply a six-step prioritization process. Each program manages its prioritization based on its own planning cycle.

NASA's Program Resource Guidance (PRG) requires all CoF projects follow rigorous standards for identifying and justifying their necessity and prioritization. NASA maintains distinct prioritization processes for its real property capital-related programs. While Programmatic CoF and Repair are prioritized by MDs prior to submission, the other programs use their own versions of the basic six-step process depicted in Figure 9 to prioritize projects for investment. Program managers establish timelines, documentation requirements, and prioritization criteria that are appropriate for the parameters of each program months in advance of budget formulation. Additional details for each program and their respective prioritization models are provided in Appendix A.

Step 1: Project Data Call (Needs Assessment) (2, 3)

Each program's prioritization process starts with a data call in order to assess needs. Data calls are informed by the program's prioritization criteria, ensuring all projects have

[27] *NASA's FY 2021 Volume of Integrated Performance.*

the complete information needed for evaluation and prioritization. (See Appendix A for detailed data call requirements).

As an example, FRED issues comprehensive data calls to the Centers to assess institutional repair needs across the Agency. Through these data calls, NASA has identified total needs for Institutional Repair CoF projects for execution in fiscal year 2023 and fiscal year 2024. FRED also requests an Unconstrained list of needed CoF repairs at the Centers where Centers can identify all of their foreseeable projects for several years out. The Unconstrained list identifies $1.8 billion of desired infrastructure repair projects that Centers project for several years to come. The data call used for this needs assessment covered two parts:

- ***Part 1*** included submittal of proposals, from the NASA Field Centers, for prioritization of Major Repair Institutional CoF Risk-Informed CoF projects. Projects submitted for prioritization may include Major Repair projects and Renewal by Incremental Repair (RxIR) projects. The RxIR projects typically consist of phased horizontal infrastructure renewal projects that are prioritized as Institutional Repair rather than Institutional Renewal. All proposed projects submitted for prioritization were to be developed with a strategic view of the Agency mission.

- ***Part 2*** consisted of developing and/or updating each Center's "Unconstrained List" of Institutional Repair CoF projects. Centers were requested to identify outyear projects for execution within the foreseeable horizon in an Unconstrained List. "Outyear" was defined as projects that may need to be executed sometime between FY25 - FY29.

Step 2: Project Evaluation (2, 3)
NASA uses a variety of tools for evaluating projects, including regular benefit-cost or cost-effectiveness analysis as directed by OMB Circular A-94.[28] Specific tools are tailored to the requirements of the program (e.g., repair, renewal, demolition) and include Business Case Analysis, Analysis of Alternatives, Facilities Condition Assessment, and Cost Modeling/Lifecycle Cost Analysis. During project evaluation, the integrated project team determines criteria such as: availability, affordability, costs and benefits, sustainable design principles, and risk. Examples of some of the project evaluation tools NASA uses are noted below.

Business Case Analysis. Centers are required to conduct analysis of alternatives as part of NASA's master planning process through the business case analysis process. As such, a business case that considers alternatives is required for all facility and real property proposals. Business cases are reviewed by FRED personnel for approval. During this analysis, the following alternatives are considered: Status Quo, Renovation, Renovation/New Construction Mix, New Construction, In-Leasing, Other Land/Facilities within NASA, Outsourcing, and Public-Private Partnership. The analysis can include all

[28] *"Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" (October 29, 1992)* Circular A-94 (whitehouse.gov).

alternatives that meet the project requirements.[29] There are five recommended sequential steps in the development of a NASA business case. The steps include:

1. *A clear articulation of the project background or situation to be studied.*

2. *A complete description of the non-monetary considerations and criteria to be considered to ensure the best solution is chosen.*

3. *A complete description and financial analysis of alternatives that could potentially provide a good solution for NASA.*
4. *A summary of the results and recommendations, including: analyzing the life-cycle costs, analyzing the initial costs, and creating a decision matrix.*

5. *Development of executive brief.*

Facilities Condition Assessment. NASA regularly assesses its facilities and infrastructure for overall readiness to support Agency mission and operations. An important element of this assessment is the condition of Agency facilities. To support this assessment, NASA utilizes different facilities assessment measures including the Facilities Condition Index (FCI). Developed in collaboration with other Federal agencies, academia, and private industry, FCI categorizes facilities into the following conditions:

5: Excellent. *Only normal scheduled maintenance required.*

4: Good. *Some minor repairs needed. System normally functions as intended.*

3: Fair. *More minor repairs and some infrequent larger repairs required. System occasionally unable to function as intended.*

2: Poor. *Significant repairs required. Excessive wear and tear clearly visible. Obsolete. System not fully functional as intended. Repair parts not easily obtainable. Does not meet all codes.*

1: Non-functional. *Major repair or replacement required to restore function. Unsafe to use.*

0: Non-existent. *The zero rating identifies that this system does not exist within the facility.*

Cost Modeling and Life-cycle Cost Analysis. All construction projects (including Programmatic CoF) require a budget narrative and a Life-cycle Cost Analysis (LCCA) in compliance with OMB Circular A-94 using ECONPACK. The budget narrative and LCCA are submitted to FRED during the prioritization process. The budget narrative is

[29] *NASA Business Case Guide, 2010*
https://www.hq.nasa.gov/office/codej/codejx/Assets/Docs/NASA_Business_Case_Guide_11_29_10.pdf.

best explained in the NASA Business Case Guide for Facilities Projects and should provide a rationale and/or mission impact for the CoF Project and how the project advances NASA's strategic rightsizing goal and OMB's *Reduce the Footprint* requirement. The LCCA must include an evaluation of existing facilities and capabilities that could be modified and upgraded to meet new requirements as a consideration and provide a strong economic basis for construction of any new capability or facility.[30]

Step 3: Project Prioritization

Each program conducts prioritization based on its own relevant criteria. Examples of factors and criteria include:

- *Repair:* project description, LCCA (ECONPACK or other economic analysis), project scope consistent with proposed repair, proposed repair consistent with lowest life-cycle cost mitigation, normalized Risk Assessment, and Risk Criticality Score.

- *Renewal:* submission of valid, approved FDC, relevance to CIPP, CMP, AMP, and NASA strategic objectives, LCCA, readiness of design, status of repair elements, relevant mission schedule, and other external factors.

- *Demolition:* footprint reduction, design status, Center past performance, years awaiting demo, Agency priority, FCI, facility O&M, demolition cost.

- *Energy:* investment amount, estimated annual energy/water use avoidance, dollars invested per million Btu energy avoided, dollars invested per thousand gallons water avoided, estimated annual energy/water and other related cost avoidance, means of executing project, means of establishing baseline consumption and quantifying/verifying actual avoidance, and contribution to whole-building performance.

- *Leasing:* absence of any requirement for a NASA program, absence of any negative impact to NASA's mission; lack of interference with NASA operations; and fair value received.

Step 4: Center Reclama

Once the appropriate stakeholder team has completed initial prioritization of submitted projects, the Centers have the opportunity to review the list and request reconsideration of specific factors (e.g., normalized Risk Assessment, Risk Criticality Score) that may influence overall scoring and prioritization order.

Step 5: Prioritized List Finalized

The appropriate prioritization team reviews the inputs from Centers and, where appropriate, adjusts the prioritization order. The team also updates any relevant "cut-lines" based on budget status. The relevant leadership team reviews, approves, and finalizes the results of the prioritization.

[30] *NASA Space Flight Program and Project Management Handbook, NASA/SP-2014-3705.*

Step 6: Agency Project Submittal
Once the prioritized list is finalized, approved projects are entered into the relevant database for execution. For the projects on the final approved CoF list, the respective Centers enter the requisite data into the FRED facilities management database in preparation for receiving Facilities Planning and Design funds to initiate project design.

Prioritization Process Notes:

- Institutional Renewal CoF prioritization process formulates the Agency's rolling 5-year Renewal CoF Plan for all assets, which is updated annually.

- Institutional Repair Prioritization is part of a two-year repair planning/execution process.

- Demolition prioritization is part of a five-year demolition planning/execution process.

- Energy Savings Investments Prioritization is part of a two-year energy planning/execution process.

6. Affordable Portfolio Gap Assessment

NASA's real property assets management efforts and related goals are significantly influenced by its desire to achieve an affordable real property portfolio. This section will discuss NASA objectives with regard to an affordable real property portfolio and specific gaps in its ability to achieve this vision.

Master Planning Goals
NASA balances many priorities in its real property management process. The Agency seeks to maintain an affordable portfolio in support of Strategic Objective 4.6 of the NASA Strategic Plan (2018): *Sustain Infrastructure Capabilities and Operations*. Measurable goals in support of this objective were identified using lessons learned from stakeholder interviews, existing Agency planning documents and guidance and results from previous Agency Master Planning efforts. The NASA AMP, currently under development, has six goals tied to the NASA Strategic Plan. While all six AMP goals have affordability implications, Goal 3 focuses particularly on affordable portfolio vision.

Goal 1: Mission Driven & Adaptable to Transformation in order to provide a viable AMP in alignment to mission requirements. This goal supports mission success through integrated strategic management, collaboration and buy-in from all mission stakeholders, and mission-driven business cases for funding requests, ensuring a robust and comprehensive real property management effort to achieve an affordable portfolio.

Goal 2: Ensure Stakeholder Accountability for effective governance and stewardship of Agency-wide assets. MDs and OSI jointly track and manage datasets for mission critical assets that are tied to real property, have O&M responsibilities that are aligned with MD

utilization rates, and ensure the AMP is managed through an effective governance structure. This results in data-driven, effective, and cost-effective real property management efforts.

Goal 3: Identify and Manage an Affordable Portfolio to efficiently sustain our Agency's assets in meeting mission requirements. The intended outcomes of this goal are for missions to be accountable for O&M costs for the assets they use, divest of excess capabilities through out-granting or other means, reduce institutional O&M costs, reduce and mitigate risk, provide guidance for Centers, right-size the Agency's portfolio to be sustainable, enable a work from anywhere culture, and provide clear strategic guidance for the Agency's maintenance strategy through the following three measurable objectives:

Objective 1: Fund O&M appropriately for mission-critical assets based on mission needs and asset condition.

Objective 2: Consolidate the Agency's Footprint through the following seven (7) strategies:

1. *Affordability Target:* NASA utilizes a multipronged strategy to pursue this goal, including limited new construction, consolidation, modernization, limited leasing, enhanced out-granting, disposal, and demolition. Centers are expected to demonstrate a plan to meet the 25 percent cost-reduction goal in order to receive final approval of their CMPs. Measurement consists of establishing a baseline metric of facility holdings and tracking changes to that metric since the baseline year, either in terms of overall square footage and current replacement value (CRV), or in maintenance costs.[31]

2. *Disposal Target:* The Agency has initiated a disposal target of 7 percent of the Agency's assets that are rated obsolete over the next five to ten years. Prioritize assets with annual O&M > $100K.

3. *1:2 Construction Offset Target:* The Agency has initiated a construction offset target that for every one square footage constructed the Agency will divest of two square feet.

4. *Divest of Excess Capabilities* through out-granting or other means.

5. *Consolidate Workplaces.*

6. *Assess & Eliminate Inefficient/Excess Storage.*

7. *Enforce On-site Office Space Standards.*

[31] With OSI approval, Centers may propose an appropriate baseline year that ensures they receive credit for applicable footprint reduction prior to the official initiative.

Objective 3: Optimize sustainment of the Agency's assets through the following five initiatives:

1. *Prioritize Reliability Centered Maintenance (RCM) and Condition Based Maintenance (CBM) Projects.*

2. *Prioritize Critical Assets for Tiered Maintenance.*

3. *Align Retro-commissioning Projects to the Center Master Plans.*

4. *Align the Center Master Plans to Facility Condition Assessments.*

5. *Prioritize Renovation/Reuse of Assets.*

Goal 4: Risk Management. Develop an integrated long-term Risk Mitigation strategy for our Agency's assets. Resilience Plans are standardized Agency-wide and incorporated into the AMP and CMPs to help prioritize CoF risk repair projects. All at-risk mission critical real property is identified and integrated to ensure proactive mitigation and efficient real property management to achieve an affordable portfolio.

Goal 5: Resource Stewardship. Implement sustainability best practices. This goal includes considerations for resource conservation and cost savings (e.g., energy and water use) and identification and responsible management of cultural and natural resources in alignment with AMP. It also ensures that NASA's infrastructure remains relevant to its mission.

Goal 6: Centralized Consolidated Campus. Well-designed campuses and workplaces recruit and retain talent needed to meet our Agency's missions. This includes centralized non-hazardous working areas to maximize the positive impact and efficiency of workforce amenities, such as food service, recreation, and collaboration spaces. Consolidation of work areas attract, engage, collaborate, innovate, and inspire our workforce as well as minimize costs of infrastructure to support the traditional geographically sprawling facility orientation of many NASA Centers.

Real Property Management Metrics

In addition to tracking and reporting metrics that have been statutorily required for Federal initiatives, such as *Reduce the Footprint* and energy intensity reductions, NASA sets performance goals and targets that are reported annually in the *Volume of Integrated Performance*.[32] Metrics related to real property are reflected in the *Enable* theme, under "Strategic Goal 4: Optimize capabilities and operations." The objectives that tie to real property capital planning and the Agency's affordability goals are listed below.

Strategic Objective 4.2: Enable space access and services.

[32] https://www.nasa.gov/sites/default/files/atoms/files/fy2021_volume_of_integrated_performance.pdf

Performance Goal 4.2.8: Ensure the strategic availability and maintenance of facilities that are necessary to meet the long-term needs and requirements of the Agency.

- FY 20-21 Performance Plan Goal: 4.2.6 - Maximize the availability of the Space Environment Testing Management Office portfolio of assets to meet NASA's current and future needs.

- Measured as: Percent of overall availability of Space Environments Testing Management Office (SETMO) portfolio assets.

- 2020 Target: 90 percent.

- 2021 Target: 90 percent.

Strategic Objective 4.6: Sustain infrastructure capabilities and operations.

Performance Goal 4.6.1: Between 2018 and 2022, support the demolition and elimination of obsolete and unneeded facilities.

- FY 20-21 Performance Plan Goal: 4.6.1 - Demolish and eliminate obsolete and unneeded facilities to reduce the Agency's overall footprint.

- Measured as: Square footage or facilities reduced.

- 2020 Target: 100,000 square feet or 20 facilities.

- 2021 Target: 100,000 square feet or 20 facilities.

Performance Goal 4.6.2: Ensure that NASA continues progress toward implementing the targets and goals reflected in its annual Sustainability Plan.

- FY 20-21 Performance Plan: 4.6.2 - Improve NASA's ability to operate facilities sustainably and reduce overall resource demands.

- Measured as: Percent of sustainability goals met annually in the OMB Scorecard for Efficient Federal Operations/Management.

- 2020 Target: 100 percent.

- 2021 Target: 100 percent.

Performance Goal 4.6.3: Between 2018 and 2019, demonstrate increased facility reliability by reducing spending on unscheduled maintenance by one percent annually.

- FY 20-21 Performance Plan: 4.6.3 - Demonstrate increased facility reliability.
- Measured as: Percent reduction in unscheduled maintenance from previous year's actual unscheduled maintenance.
- 2020 Target: one percent below FY 2019 actual unscheduled maintenance.
- 2021 Target: one percent below FY 2020 actual unscheduled maintenance.

Affordability Gap Analysis

NASA's legacy assets are a rich heritage, but some have become a liability to the extent that they are mismatched with current Agency mission requirements. The key challenge to supporting NASA's highly technical and dynamic programs is maintaining and modernizing facilities that were designed for a different age; this requires continual monitoring and assessment of which assets can still support the technical mission and proactive divestment of those that cannot. In support of this mission, NASA monitors operating costs, facility utilization, facility condition, and mission dependency data and uses these data to determine reinvestment priorities.

At the most fundamental level, NASA seeks to maintain facilities that are ready for its mission programs. NASA leverages many industry models and measures to characterize the readiness of its facilities, including a facility condition index and, where necessary, the use of CRV as an indicator of the present value of investment in a facility. However, gaps remain that are inherent to managing aging infrastructure within a constrained budget environment and will continue to worsen over time if significant improvement steps are not taken. A discussion of these gaps below indicates the severity of the challenge NASA faces in managing its real property assets. Final affordability will be achieved by understanding total cost, implementing asset right-sizing measures discussed above, and closing the gaps discussed herein.

Resource Gap. There is a fundamental mismatch between NASA's aging physical assets and the resources available to maintain an operational infrastructure. Substantiating this predicament, Figure 10 portrays historical data presenting trends over time for NASA budget and identifies needs and the respective gaps. The "Budget" row presents the Agency's total spend

Historical ($M)					
	2015	2016	2017	2018	2019
Budget	612.83	624.15	627.16	616.56	625.00
Needs	652.92	665.98	679.30	692.88	706.74
Gap	**40.09**	**41.82**	**52.13**	**76.33**	**81.74**

Projections ($M)					
	2020	2021	2022	2023	2024
Budget	625.00	625.00	625.00	625.00	625.00
Needs	720.88	735.29	750.00	765.00	780.30
Gap	**95.88**	**110.29**	**125.00**	**140.00**	**155.30**

Figure 10. Historical and projected budgets demonstrate that the O&M budget is insufficient to meet NASA's sustainment needs.

in O&M in previous years (historical) and the projected flat line estimate for future year funding. The "Needs" row is defined by a full O&M cost analysis for FY22 ($750M) with two percent inflation built on other years. A closer examination of these numbers and the associated graphic makes it clear that while NASA has received a fairly stable amount of funding over the years, it experienced a consistent increase in its sustainment needs resulting in an ever-growing gap in its O&M budget. Projections based on these historical trends confirm that aging facilities and increasing costs for maintenance and repair will continue to place additional pressure on NASA's limited infrastructure budget, putting critical facilities at risk (Figure 11).

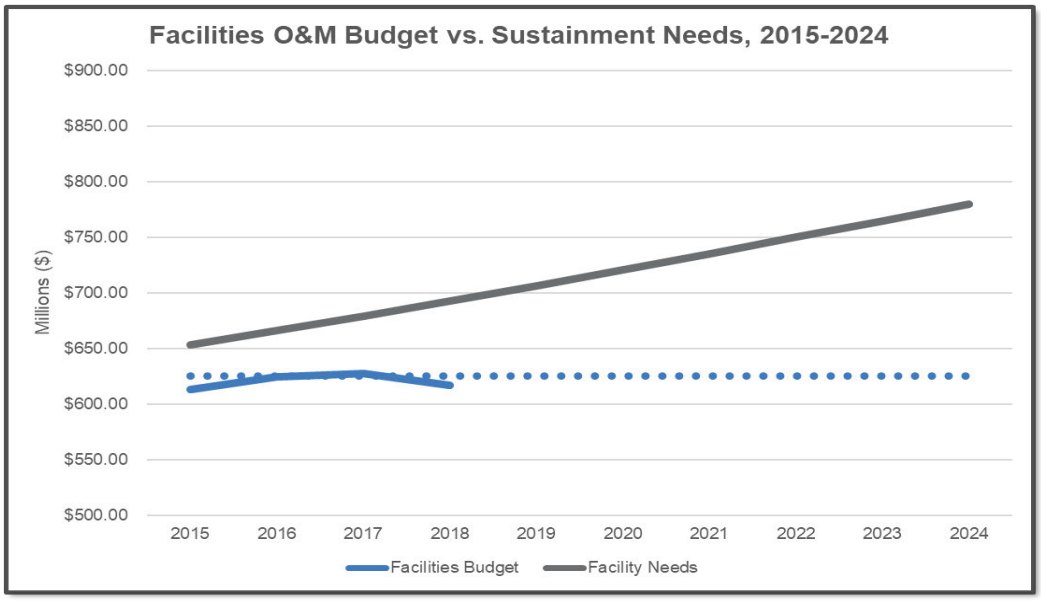


Figure 11. The trajectory of sustained/increased infrastructure demand, flat-lined operating budgets, and deteriorating infrastructure health leads to an unsustainable pathway, which could result in critical failures.

Maintenance Backlog. The above-discussed trends have increased NASA's deferred maintenance backlog over time (Figure 12). This plot of the cumulative gap in O&M Needs versus Budget tracks with the growing deferred maintenance estimate, showing the likely relationship. Currently, NASA carries a $2.66 billion backlog in deferred maintenance for existing facilities. Given present-day resources, Centers are forced to allow some facilities to run to the point of failure and then fix them. This results in ongoing reaction to failures with resources that could have been used for preventive maintenance, thus a continuing increase and imbalance of unplanned to planned maintenance spending ratios. Most years, a large percentage of the construction budget is dedicated to making substantial repairs to stem maintenance backlog and address the highest risk to the Agency's infrastructure. Additionally, the net renewal funding is sufficient to fund only a few phases of RxIR projects and one or two new replacement facilities annually. NASA is currently revisiting its deferred maintenance metrics to adjust for mission criticality and required condition parameters. Though these adjustments may reduce the overall dollar amount of the backlog, substantial gaps will remain.

Facilities Condition. Only 17 percent of NASA facilities are less than 40 years old. The majority of older NASA facilities were designed for a specific mission requirement and due to technology advancements and life/safety code changes, likely require renewal/renovation to ensure that they can be repurposed for current mission requirements. The Agency inherited about one third of its facilities from predecessor organizations, particularly the Department of Defense. Approximately one half of the remaining NASA facilities were built for the Mercury, Gemini, and Apollo programs that ran through the 1960s and early 1970s. NASA spacecraft now routinely incorporate electronics that are sensitive to electrostatic discharge due to even small changes in temperature, humidity, and cleanliness; however, older buildings were not designed to satisfy such requirements. The heating, ventilation, and air conditioning systems installed to satisfy the new requirements complicate and add to the expense of the development, integration, and testing of flight hardware, and this is just one example of how technology has changed requirements for NASA's facilities.

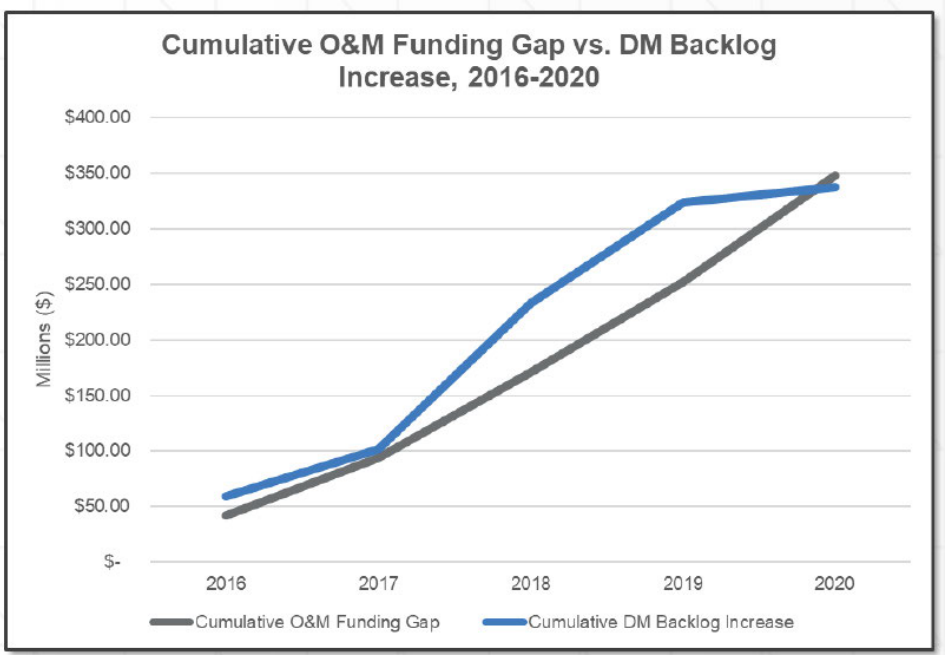


Figure 12. Continued underfunding has increased NASA's deferred maintenance backlog over time. Between 2016-2020, the deferred maintenance backlog grew by approximately $337M. In the same duration, the total funding gap between O&M spend and sustainment needs grew by $348M.

The NASA Mission Dependency Index (MDI) indicates that a relatively high proportion of NASA's facilities (over 60 percent by value) are considered to have "critical" or "significant" mission need—the two highest tiers on the MDI—meaning that potential failures associated with these facilities could seriously interfere with program and mission commitments.

Sustainment Budget Benchmark Gap. NASA has developed a funding cost model that it uses as a basis to justify the SSMS funding it needs to sustain its infrastructure. The cost model estimates costs for average annual maintenance and repair (sustainment) and operations costs for specific types of facilities based on historic NASA data as well as

actual cost data for several of NASA's buildings, which was then extrapolated across like buildings within the NASA portfolio. One study using this cost model (developed by CBRE/Whitestone) estimated total costs for Administration Buildings at $97.3 million per year, or $11.46 per GSFT; this represents 4.5 percent of CRV.[33] Current sustainment funding, however, roughly equates to 1.41 percent CRV.[34] This amount only sustains facilities at their current condition and normal wear and tear; it does not account for funding required to improve the facilities' condition.

Though this particular study covered one type of building (Administration), its findings track with benchmarks established by National Academy Press and the Federal Facilities Council, which estimates that the appropriate funding for maintenance and repair for Federal agencies is between two and four percent. Together, these studies suggest NASA's sustainment budget has been historically underfunded and should be adjusted to ensure the Agency has the funding to sustain its infrastructure as well as improve its condition, rather than carrying an unfunded risk every execution year.

7. Controls & Monitoring

The NASA master planning process provides a set of controls and monitors with respect to real property planning. The process for master planning specified in NPR 8810.1, *Center Master Planning*, requires Centers to validate or update the master plan for their facilities every five years. Changes to the Agency's strategy, resources, or assigned programs can prompt earlier reconsideration. Centers record their requirements, development concepts, implementation priorities, and strategic outcomes, testing this early work in reviews with Agency-level stakeholders. With Agency approval, Center master planners create a Future Development Concept that is vetted with stakeholders. Once the concept is approved, the Centers expand the details into technical documents, capital improvements plans, and outcome projects and present their complete master plan to NASA institutional leaders in the Mission Support Council for final acceptance.[35] On average, two Centers update and gain approval of their CMPs every year.

Each CMP covers a 20-year planning window, but also contains four five-year CIPP built into the document. The Agency identifies a budgetary control for funding CIPPs, and each Center receives an allocation for each five-year cycle. Although a Center's CIPP covers five years, they may receive funding in any year of the plan. The budget amount and timing both function as controls, as Centers are unable to spend money prior to their allocation, even if it is indicated in their plan. It should be noted that in cases of funding reductions or delays to budget allocations, Centers extend their CIPP plans to cover more than the expected five years. If the final appropriation falls short of NASA's request, NASA endeavors to fund its highest priority projects within the appropriation level and the remaining projects move into the outyears, delaying progress toward renewal, consolidation, and reduction targets.

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[33] *Operations & Maintenance Cost Study for NASA Facilities Final Report for Administration Buildings (February 10, 2014).*

[34] Based on PPBE22 data.

[35] *AMP Revision Draft 11-14-2019 ldv revisions.*

Projects are funded in accordance with the President's Budget Request. Once funding is received, it is distributed to Centers based on established spending plans. Projects are managed at the local, Center level with Program Managers within FRED monitoring the status of all construction projects across the Agency. Program Managers review project status via monthly reports, which include cost, schedule, and technical risk. NASA is moving toward establishment of executive project managers (EPMs) who will monitor, advise, and provide additional oversight for large and/or technically complex construction projects.

NASA continuously monitors its real property assets in terms of its supply, as well as demand as determined by current and projected mission requirements. The results of this monitoring inform prioritized projects lists, budgets, and decisions on which gaps must be addressed in order to optimize usage of the Agency's inventory. Performance measures such as operating costs, facility utilization, facility condition, and mission dependency help shape NASA's real property capital investment strategies. O&M plans for NASA's assets are controlled and monitored at the Center level to ensure proper management of assets for best return on investment. Strategies for improving maintenance efficiency and effectiveness are discussed in the following section.

8. Challenges and Opportunities

NASA faces many challenges in stewarding its large, aging portfolio of real property. However, the Agency has also identified many opportunities for improving its situation and optimizing efforts to align its facilities with its evolving missions.

Challenges

Although facilities consolidation and modernization efforts rely on robust assessments that indicate footprint reduction is a key requirement for NASA's future viability and mission success, NASA recognizes a number of challenges and constraints that limit feasible actions and occasionally slow down progress. Acknowledging these constraints is prudent for strategic thinking and effective planning activities of the Agency, Centers, MDs, and other key internal and external stakeholders.

Constrained Budget. The Agency's ability to renew its facilities is driven by the amount of the construction budget that can be directed toward new construction or distributed system recapitalization. An investment of ~$600 million annually in institutional CoF is needed to meet the Agency's identified goals to repair and renew. Every year that NASA does not receive its full CoF request, the Agency must readjust priorities, delaying required renewal and repair projects. Delaying projects, however, leads to increased sustainment costs, since repairs become more costly as the buildings continue to age and deteriorate in condition. NASA will suffer more frequent expensive breakdowns, requiring repairs that are more expensive than capital renewal expenditures would have been. Most importantly, as the Agency's facilities become increasingly obsolete, risk of mission failure increases over time.

Political Constraints. As part of a broader Government system, NASA must conduct its operations and provide its services within an environment that is inevitably political.

Although political considerations may shape NASA operations in different ways (e.g., decisions on Agency mission, funding, and priorities), their relevance to NASA's facilities direction and related initiatives is especially important to note during master planning. As an Agency that is at the forefront of advancements in aeronautics, space science, and exploration, NASA's presence brings prestige as well as prosperity to the surrounding local communities and geographic regions. For these reasons, NASA's efforts to divest physical assets that are not justified by its current and future mission requirements may be cause for great concern for some elected officials and the local constituents whose interests they represent. In such situations, NASA may find it difficult to move forward with its ideal solutions (e.g., reducing/consolidating facilities) without losing political support. In these cases, it is important for stakeholders to understand that the overall health of NASA (and safety of its employees) depends on the Agency's ability to right-size its footprint and costs. Reduction is intended to improve the Agency's financial health, but not at the expense of capability loss or Center function. However, NASA's fiduciary responsibilities and constraints do limit its autonomy in making and implementing decisions about its facilities.

Regulatory Requirements. Facilities management efforts and related capabilities streamlining initiatives are subject to many regulatory constraints. For example, NASA must observe various environmental (e.g., National Environmental Policy Act (NEPA)) and historical preservation (e.g., the National Historic Preservation Act-NHPA, 2014) regulations in its efforts to build out or dismantle Agency facilities and supporting infrastructure. NASA facilities awaiting disposal still must be maintained in accordance with fire and other safety codes (e.g., Occupational Safety and Health Administration (OSHA) regulations) until final approval and demolition. NASA also cannot buy, sell, and divest the properties it stewards without coordinating with and obtaining approval from General Services Administration (GSA).

Data Constraints. NASA master planners need useful strategic data about facilities to properly frame or inform leadership choices. Currently, NASA compiles and stores data related to real property that has been collected from individual Centers, facilities, and other NASA organizations in RPMS. Despite containing useful information, this database often falls short of addressing the full spectrum of key considerations relevant to facilities management (e.g., facilities characteristics, readiness, and efficiency). RPMS also has some underlying process shortcomings that limit the usefulness of resulting data and descriptive statistics in generating input for facilities management and consolidation efforts.

The need for data is unceasing—there is always a need for more and more accurate and better data, but decisions need to be made on what is available. NASA master planners often operate with less than complete information, reducing NASA's ability to make the most effective decisions about facilities divestment and investment needs. There are no quick fixes to address these shortcomings at this time as NASA considers improvements to its strategic data collection and analysis processes to be a long-term effort. In the meantime, Centers are encouraged to be aware of their data's limitations and use all available local and Agency-level information when making facilities divestment and investment decisions.

Opportunities

NASA is continuously working to improve its strategies, planning processes, organization, and execution. Several initiatives below present opportunities for improving NASA's real property planning.

Improving Facilities Management Processes

BSA and MAP. Recognizing the key role that NASA's infrastructure plays in supporting NASA's missions, facilities, and real estate management was included in NASA's Business Services Assessment (BSA) process to look for opportunities for optimization. The BSA facilities assessment developed recommendations in six areas: master planning, capability leadership, divestments through demolition, divestments through lease management, renewal and investment, and maintenance management. Implementation of the decisions is ongoing as NASA adapts its processes in a systematic and efficient manner. NASA is building on this progress with its Mission Support Future Architecture Program (MAP), which seeks to transform mission support services to an enterprise operating model while maintaining mission focus, improving efficiency, ensuring local authority, and valuing the workforce. The facilities-focused phase of that initiative is planned to start in 2021, and NASA anticipates that resulting changes (e.g., regional or centralized personnel and contract solutions) will lead to more efficient operations. Future improvements include fully integrated Geospatial Information Systems for Center management across of NASA and enterprise solutions sets for maintenance technology to include enterprise Computerized Maintenance Management Systems and CBM tools.

Capability Portfolio Management. In April 2019, Agency-level policy established Capability Portfolio Management, which fosters greater efficiency in managing the utilization, upgrade, and divestment of portfolios of capabilities (e.g., space environment test assets, rocket propulsion test assets, wind tunnels, and high-end computing).[36] Capability portfolio managers work with the Centers where their designated capabilities reside. This collaboration is intended to represent Agency priorities for cross-Center capabilities in making administrative and financial decisions about capability investment, divestment, acquisition strategies, procurement, and internal and external agreements. This is a significant step in prioritizing the Agency's capabilities investments to streamline utilization and maintain NASA core capabilities while divesting of obsolete or unnecessarily redundant facilities.

Use and Availability of Data. NASA continually seeks to improve the availability and usage of data to improve its decision making. In order to get a true understanding of cost, with credibility and accountability, NASA is looking at improvements in the MDI, health metrics, utilization, maintenance and operations, mission demand, and other "source of truth" data that enable us to better manage the readiness, health, and O&M of our facilities. OSI works continuously with Centers to integrate the latest guidance and insights into the process of updating their master plans and will deliberately co-design a

[36] *NPD 8600.1, Capability Portfolio Management,* and *NPR 8600.1, NASA Capability Portfolio Management Requirements.*

number of key performance indicators to track progress. These indicators will be built on several existing or new metrics, such as capacity, obsolescence (age), degradation (condition), criticality (MDI), affordability (consolidation metrics), and sustainability (resource usage).

Facilities Reduction and Improvement

Consolidation. NASA is increasing the density and flexibility of new buildings as the Agency consolidates functions from old buildings into new replacement buildings. For example, NASA seeks to consolidate research support functions in new buildings to create more efficient use of common laboratory equipment. Buildings are designed to be easily reconfigured to continue supporting research as protocols change and new technology is added to the building. These buildings use modern laboratory configurations to provide serviceability that cannot be accomplished in buildings designed to support 1950s and 1960s research protocols. These efforts allow NASA to dispose of costly older buildings and create workforce efficiencies from consolidated and co-located functions. NASA has already completed several renovation and modernization projects. As illustrated in Figure 14, with increasing maturity and ability to forecast, NASA's annual updates to its "Reduce the Footprint" reporting to OMB envision progressively more consolidation. While this OMB program focuses on buildings and excludes other structures in NASA's portfolio, the trend suggests that NASA's consolidation goal is on target and achievable.

Figure 13. NASA has increasingly planned for consolidation and reduction in facilities management.

Disposal and Demolition. NASA follows established best practices for the disposition of its capital assets, proactively identifying buildings that are no longer needed and coordinating their disposal through a systematic decision-making process that involves

the appropriate stakeholders. NASA is sometimes able to sell or transfer facilities, sites, and/or land through GSA. NASA also leverages its demolition program to reduce its inventory of facilities. Funded by the CoF program, the demolition program is designed to eliminate or reduce real property assets that are no longer required for NASA's mission. Through this program, NASA dedicates funding to remove abandoned or otherwise unneeded facilities, eliminating the financial burden associated with the respective maintenance and operation costs.

Modernization. NASA is replacing older, costly facilities with new, energy-efficient facilities designed to incorporate cost saving technology (like CBM telemetry equipment), reduce energy consumption and operating costs, and allow for higher usage and greater population density in a more open environment. NASA's priority strategy is to construct sustainable buildings and demolish buildings that no longer meet mission needs and are therefore considered obsolete. Reflecting this, NASA continues to design and construct new high-performance sustainable facilities. NASA requires that new facilities meet the *Guiding Principles for Sustainable Federal Buildings* and earn at least a *Leadership in Energy and Environmental Design* (LEED) Silver certification by the U.S. Green Building Council (USGBC), which manages an independent third-party high-performance sustainable building verification system. The Facilities Engineering Branch is also revising the NASA policy document for new construction and major renovation requirements to include the design requirements for assessing and considering climate risk changes, as addressed in the *Guiding Principles for Sustainable Federal Buildings.* To reduce utility usage for existing buildings, NASA uses other funding opportunities including Energy Savings Performance Contracting and Enhanced-Use Lease (EUL) net revenue to implement commissioning strategies.

NASA also initiated an Existing Building Commissioning Program in FY 2018 that can help improve the reliability of facilities in achieving their original design parameters and efficiencies and reduce the cost to operate the facility by adding energy efficient systems. NASA evaluates the performance of existing facilities and makes the improvements or repairs necessary to meet performance measures that a building may have lost over time. In addition, newly constructed, sustainable buildings go through regular evaluations to ensure they are also meeting their intended requirements for sustainable design.

Maintenance Approaches

Sustainment Modeling. NASA would like to improve its sustainment modeling and is investigating ways to do so. NASA is evaluating use of the US Army Core of Engineers' BUILDER program as a potential sustainment cost model to validate Agency's sustainment costs. It will also consider using the military's sustainment model to validate maintenance and repair cost of the existing infrastructure. This would allow capital planning to focus solely on recapitalization and improvement.

Enhanced Reliability-Centered Maintenance. NASA is enhancing its use of Reliability-Centered Maintenance (RCM) principles in order to reduce unplanned maintenance. The change will be toward more strategic and proactive activities versus tactical-level and reactive actions. By embracing RCM techniques, NASA can maximize asset efficiency

while minimizing the life-cycle costs, considering that repairing an RCM "find" is expected to reduce repair cost to one-third, versus an unplanned failure. The basic premise of the program is to perform the right type of maintenance, on the right asset, at the right time, for the right reasons.

NASA launched the new strategy in January of 2020 with the issuance of NASA Interim Directive 8831.124. This process provides prioritization of resources through analysis. It is focused around the tiered maintenance principle, where mission-critical assets/facilities take precedence. In other words, facilities are ranked by tier, and assets within the facilities have their own criticality indices.

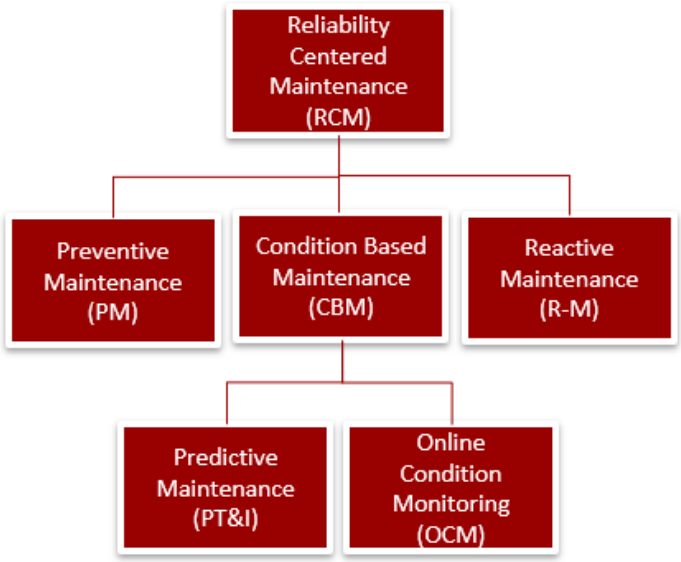

Figure 14. Reliability Centered Maintenance Components

To further provide data-driven analysis, O&M managers across the Agency are using CBM techniques as the focus of modern RCM (Figure 15). This provides an efficient middle ground between time-based/scheduled, preventative maintenance and downtime repairs that are reactive in nature. CBM is broken down into online condition monitoring and predictive testing and inspection. Onboard asset monitoring and non-intrusive corrections and adjustments are performed prior to asset failures as telemetry notifies the maintenance historian. The labor saved from transitioning to a CBM approach with limited down time for repair is reinvested back into the RCM program. NASA is also considering enhanced use of Agency-wide enterprise data historians and integrated operations control centers for analysis and work dispatch.

Evolving Facilities Management Tools

Leasing. NASA encourages Centers to consider traditional and non-traditional leasing agreements to offset facilities costs.

- *In-Grants.* NASA needs to review the leasing and long-term occupancy of non-NASA facilities and limit lease terms to meet short-term needs. As part of its strategy to reduce operating costs, NASA is focused on identifying leases that can be eliminated or reduced over time . NASA has successfully consolidated at onsite locations some administrative functions that had been conducted offsite. This has allowed NASA to release several leased facilities.

- *Out-Grants.* When it makes sense, NASA supports sustainment of facilities by taking advantage of EUL and other available authorities to lease out NASA facilities that may also support commercial use. NASA uses EUL and other authorities to provide unique NASA capabilities to industry participants and establish strategic partnerships with other Federal agencies, state agencies, academia, and industry. NASA has increased access to launch and payload processing facilities, expand testing of commercial rocket engines, partner with other Federal agencies and commercial aircraft manufacturers and operators to conduct research in NASA wind tunnels and simulators, and conduct combined science research with agencies such as the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), and the National Science Foundation (NSF).

Physical Storage Space Management. With about 15 percent of all NASA's assignable building space assigned to warehouse-type storage, NASA is committed to using storage space fully and retaining only as much storage space as its work requires.

Commercialization. NASA continues to adapt its business model to take advantage of internal and external capabilities. The Aeronautics Research Mission Directorate (ARMD) and other organizations within NASA are working to develop and formalize a "Lead, Leverage, Follow/Partner" model that would capture NASA's various roles in a technology's life cycle. The model shows NASA leading the innovation of cutting-edge technologies during research and development; then leveraging capability with academia, the private sector, and international partnerships; and, finally, partnering with industry to commercialize certain activities (e.g., access to low-Earth orbit, research on the ISS). With this model, NASA could potentially reduce costs in some areas so it would be better able to invest in emerging requirements and ensure that high-priority NASA missions are successfully executed.

IV. LIST OF PROJECTS

NASA's list of prioritized capital projects for the first year (FY21) of this plan is included as an annex Excel document to this RPCP.

V. CONCLUSION

In response to *OMB M-20-03: Agency-wide Real Property Capital Planning (RPCP) Action*, this document has provided an overview of NASA's RPCP process, including how it informs the Agency's real property-related decisions and the resulting budget requests. Given NASA's unique standing with regard to its mission, its extensive real property legacy, and the condition of its facilities, robust and comprehensive real property planning, which is a requirement entailed within OMB M-20-03, has been a critical part of the overall NASA strategic and operational planning for many decades. Agency strategic and operational planning processes translate strategies, planned missions, Agency initiatives, and other guidance into projected requirements for infrastructure and facilities. Facilities planners then conduct analytical project evaluation tools to determine needs, identify gaps, evaluate options, prioritize projects, and develop budgets. Once funding is received, facilities-focused organizations within NASA distribute,

control, and monitor activities to ensure execution is consistent with identified priorities and emerging requirements. The Agency's governance structures provide clear oversight of these real capital planning processes and NASA's extensive real property portfolio.

It is important to reiterate that recent changes in NASA's overall real property planning and management philosophy have significantly transformed the way in which these processes and practices are currently being conducted. As explained elsewhere in this document, NASA has moved away from a bottom-up approach toward a more centralized and portfolio-based approach to asset management. This new strategy promotes integration of capabilities across the Agency as well as a more mission-driven real property management process, both of which promise greater efficiencies in operations and related budgets—a critical benefit when operating in a limited resource environment. However, NASA's diverse real capital portfolio of ~5,456 facilities is too large, dispersed, and complex to steward from a purely centralized perspective without extensive coordination with multiple stakeholders. As the primary holders of NASA's unique capabilities, NASA's ten Centers have the technical and contextual knowledge required for truly informed real property decision making at the Agency level. Therefore, the new approach marries Agency-wide reflection and integrated assessment with close coordination and consultations with Centers and other stakeholders for efficient and strategic management of the Agency's real property portfolio. To achieve this vision, MSD and OSI closely support and monitor Center budgets and master planning processes, providing a critical link to Agency priorities and a broader perspective on enterprise-wide capabilities and trends to inform real property decision making. NASA then uses analytic methods to determine the most cost-effective methods to ensure NASA's capabilities meet ever changing mission needs. While still evolving, NASA intends to further strengthen this Agency-directed, centralized real capital planning approach as part of a transition to enhanced enterprise-wide planning and execution of mission-support functions. NASA looks forward to coordinating with OMB as it continually strives to improve its planning processes and practices to responsibly and effectively steward its extensive real property portfolio.

While NASA implements the processes discussed above, the Agency must still aggressively take steps to understand its true facility cost, right-size the infrastructure portfolio, and seek regionalized or centralized solutions that can lead to more efficient operation. The success the Agency has seen is positive, but incremental. With the recent development of data-driven processes like the AMP, MAP, and enhanced maintenance strategies, MSD and OSI are poised to drive the Agency to an affordable infrastructure portfolio. Right-sizing the portfolio to focus on lean mission execution will lead to more reliable structures and improve employee safety and health. We will carefully monitor progress toward these goals in coming years and continue to evolve our RCPC where needed.

APPENDIX A: PRIORITIZATION PROCESS DETAILS

Capital Program Prioritization Processes

NASA maintains distinct prioritization processes for the following five real property capital-related programs:

- Renewal (Recapitalization) Program.
- Repair (Sustainment) Program.
- Demolition Program.
- Energy Savings Investments Program.
- Lease Program.

The first four (renewal/recapitalization, repair/sustainment, demolition, and energy savings investments) are managed as part of the CoF program.

	1	2	3	4	5	6
	Project Data Call	Projects Evaluated	Project Prioritization	Center Reclama	Final Project List	Agency Submittal
Institutional Renewal Program (Recapitalization/Acquisition)		✓		✓	✓	✓
Programmatic Renewal Program (Recapitalization/Acquisition)	✓	✓	✓	✓	✓	✓
Repair Program (O&M/ Sustainment)	✓	✓	✓	✓	✓	✓
Demolition Program (Disposal)	✓	✓	✓	✓	✓	✓
Energy Savings Investment Program	✓	✓	✓	✓	✓	✓
EUL Program		✓		✓	✓	✓

Renewal Program. The overarching objective of the Renewal Program is to renew the Agency's institutional real property assets over the entire service life of its facility inventory in order to maintain operational capability. The purpose of the Agency's

Renewal CoF prioritization is to formulate the Agency's rolling five-year Renewal Cof Plan for institutional assets and gets updated annually adding another year.

Renewal Prioritization Process: Renewal prioritization is part of a fivr-year renewal planning/execution process. T he renewal prioritization consists the following three steps:

1. *Candidate Projects Submitted (FDC Approval):* For candidate renewal project to be considered, a Center must have a valid Facility Development Concept (FDC) that has been approved by the Agency's Mission Support Council (MSC) within the past five years. The FDC contains the baseline information of a Center Master Plan (CMP) tied to the Agency Master Plan (AMP) which reflects strategic program decisions such as the Agency Strategic Plan, Workforce Strategic Plan, information technology plans, and the Agency Mission Planning Model. As part of the FDC deliverables, a Capital Investment Program Plan (CIPP) is required that outlines all candidate renewal projects coordinated and planned within master planning funding guidelines. A Life-Cycle Cost Analysis (LCCA) is required to be submitted to OSI FRED for all candidate proposed projects. [37]

2. *Candidate Projects Evaluated:* OSI FRED reviews the CIPP and the corresponding Business Case Analyses before adding a candidate project to the rolling year five-year plan.

3. *Projects Added to Renewal CoF Plan:* Once the project(s) has been validated, it is added to the Renewal CoF Plan. The Renewal CoF Plan is a living document that is defined as two plus three (2+3) year planning document. The rolling five-year plan is managed based on the budget available and not based on any allotment to a Center. OSI releases the two plus three (2+3) year rolling five-year plan in the Budget briefing to the MSC in early summer as part of the PRG briefing cycle. Only the plans for the proposed fiscal year are resolved. Any out-year projects are subject to change based on the outyears funding level guidance.

Repair Program. The overarching objective of the Repair Program is to restore Agency-owned facilities and components to their originally intended condition, capacity, efficiency, or capability. The specific repair projects are one-time facility work to restore a facility sub-system or component or collateral equipment that has failed or history of failure or is about to fail.

The Repair Program can be separated into Institutional Repair CoF and Program Direct CoF. Institutional Repair CoF is responsible for funding CoF-level projects that repair the Agency's institutional infrastructure as required to ensure that the Centers can support the Agency missions. Program Direct CoF is responsible for funding CoF level projects that are required for the execution of specific mission directorate programmatic requirements.

[37] *https://fred.hq.nasa.gov/Assets/Docs/2015/NASA_HandbookForMasterPlanning-2_TAGGED.pdf*

Institutional Repair CoF: All non-Program Direct CoF level projects consistent with the definition of "Repair" as described by: the facility work required to restore a facility or component thereof, including collateral equipment, to a condition substantially equivalent to its originally intended and designed capacity, efficiency, or capability. It includes the substantially equivalent replacements of utility systems and collateral equipment necessitated by incipient or actual breakdown.

Institutional Repair Prioritization Process: Repair prioritization is part of a two-year repair planning/execution process. The repair prioritization consists the following five steps:

1. *Data Call:* The prioritization process is initiated by OSI FRED in July of even-numbered years with a Data Call. The Data Call allows the Centers to submit repair projects for prioritization to be included in the Agency's two-year CoF Repair Plan. The submittals are required to be in alignment with the AMP and a Center's approved FDC and CDP.

2. *Project Presentations:* Centers present submitted projects including a risk assessment to a Stakeholder Team consisting of representatives from OSI, the Mission Directorates, and other Stakeholders. OSI FRED reviews the presentations and submitted documents to verify consistency with Agency guidance, verify that the project scope is consistent with the proposed repair, verify that the proposed repair is consistent with the lowest life-cycle cost mitigation, and adjust the prioritized order as necessary.

3. *Preliminary Scoring:* Following the presentations, the Stakeholder Team reviews each Project Documentation Package and may issue written questions to the Centers regarding the project(s). Upon receipt of written answers to questions, the Stakeholder Team normalizes the Risk Assessments to ensure completeness, consistency with the Data Call guidance, and consistency across all Centers. Preliminary priority order of the projects is based on the normalized Risk Criticality Score. Projects with higher Risk Criticality Scores have higher priority, and projects with lower scores have lower priority. A Secondary Filter is applied in the event of a numerical tie in the Risk Criticality Score for various projects. Step 3 concludes with the release of the list of submitted projects in draft prioritized order.

4. *Reclama (optional):* Centers have the opportunity to reclama the normalized Risk Assessment(s). The Risk Assessment(s) and corresponding Risk Criticality Score(s) may then be updated by the Stakeholder Team with respect to a reclama, and project priority will be re-evaluated based on the updated normalized scores. This Step concludes with the release of an updated list of submitted projects in draft prioritized order. A "cut-line" is identified on this list, which corresponds to the expected availability of funds.

5. *Approved Project List:* The Stakeholder Team convenes to review the draft list of prioritized projects and associated documentation. This review is to verify that the

Repair Prioritization Process was faithfully executed, and to adjust the draft prioritized list as appropriate for consistency with the Repair Prioritization Process. This step concludes with the release of the list of selected Repair projects in prioritized order. For the projects on the final approved list, the respective Centers enter the requisite data into the FRED facilities management database in preparation for receiving Facilities Planning and Design Funds to initiate project design.

Program Direct Repair CoF: Programmatic CoF covers major repairs/modifications as well as construction of additional capacity/capability to existing real property assets that are required specifically for the execution of MD programs and/or projects. Programmatic CoF also covers new construction and demolition that are outside of the scope of repair. Each MD conducts their own approval processes and establishes timelines for determining which CoF projects will be implemented in any given year. OSI/FRED monitors this process, using standard documentation requirements to make sure they clearly understand the intent of the projects and to ensure all projects comply with all applicable Agency and Federal policies. MDs prioritize projects prior to submission.

Demolition Program. The overarching objective of the NASA Demolition Program is to "eliminate inactive obsolete facilities that are no longer required for NASA's missions" and to allow the "Agency to avoid non-productive operating costs required to keep abandoned facilities safe and secure." The five-year Demolition Plan is also the primary disposal strategy for how the Agency meets the requirements of *OMB Memorandum M-12-12 Section 3: Reduce the Footprint* which directs agencies to "move aggressively to dispose of surplus properties held by the Federal Government, make more efficient use of the Government's real property assets, and reduce the total square footage of their domestic office and warehouse inventory…."

Demolition Prioritization Process: Demolition prioritization is part of a five-year demolition planning/execution process. The demolition prioritization consists the following four steps:

1. *Data Call, Data Collection and Entry* – A data call is initiated by OSI FRED in July of every year. The data call allows the centers to submit demolition projects that will be included in Agency's five-year demolition plan. Centers are encouraged to submit as many facilities as possible for demolition but the submittals are to be consistent with the Agency Master Plan and their approved FDC and CDP. All project information and documentation will be collected, entered and, kept in the FRED facilities management database. There are two categories of demolition projects in the data call:

    - Demolition projects that are in the previous five-year plan. Centers are asked to confirm, validate, or update current project information (e.g., changes in demolition cost, changes in the planned execution year, etc.).

- New demolition projects (not in the previous five-year plan). Centers are asked to provide basic project information.

- For demolition projects proposed for execution in the funding year (first year of the five-year plan), Centers are required to submit the following supporting documents:

    - 1509/1510

    - Quad Chart (for facilities with CRV > $20M).

    - Project Narrative and Action Summary.

    - Approved Disposal Letter from the Center Director and concurred with OSI.

    - HUD Screening Documentation.

2. *Data Validation:* After all the data and documents are entered into the FRED facilities management database, the Headquarters Demolition Program Manager conducts individual meetings with all the Center Demolition Program Managers to:

    - Confirm and validate the accuracy of the data submitted.

    - Have a clear understanding of the intent and scope of the individual projects submitted.

    - Make a determination if institutional demolition funds are the appropriate funding source for the demolition action contemplated.

    - Review the completeness of the documents and information submitted.

    - After individual discussions with the Center demolition program managers, the Agency Demolition Program Manager prepares a consolidated list of all valid project submission, which will be the basis of discussion in the Demolition Program Managers prioritization meeting.

3. *Prioritization Meeting:* A demo prioritization meeting is held no later than the September before the funding year (first year of the five-year plan) and is attended by all Center Demolition Program Managers and facilitated by the Agency Demolition Program Manager. The primary focus of the meeting is to formulate the Agency's five-year demolition plan and to rank-scoring of all demolition requests. The five-year plan includes a spend plan for the first year and the validation of remaining four years that reflect the cCenters' long-term demolition goals. All real property assets proposed for demolition are scored using the following factors illustrated in the tables below. The purpose of the scoring is to ensure that limited funding resources are used toward demolition candidate projects that best meet the

objectives of the Agency's Demolition Program (i.e., meet reduce the footprint commitments and reduce operational cost).

A prioritized rank-order list is developed based on a "bundled" Center score (average of all individual candidate facility scores at a Center). Once projects are approved, a determination is made regarding the best contract vehicle (Center-procured, U.S. Army Corp of Engineers Facilities Reduction, etc.) for the projects that made the "cut."

1. Footprint Reduction		
100K+	5	**350**
50K-99K	4	
25K-49K	3	
5K-24K	2	
1-4999K	1	
2. Design Status		
Complete	5	**100**
Not Complete	0	
3. Center Past Performance (OBL Rates)		
91% - 100%	5	**100**
85% - 90%	3	
84% and below	0	
4. Years Awaiting Demo (Funding Year - Anticipated Disposal FY)		
5+ years	5	**100**
4 years	4	
3 years	3	
2 years	2	
0 - 1 year	1	
No Anticipated Disposal Date	0	

5. Agency Priority (Y/N)		**100**
Yes	5	
No	0	
6. Facilities Condition Index		
1.0 and below	5	**50**
1.01 - 2.0	4	
2.01 - 3.0	3	
3.01 - 4.0	2	
4.01 - 5.0	1	
7. Facility O&M (5-yr avg)		
$150K+	5	**100**
$40K-$150K	4	
$15K-$40K	3	
$3K-$15K	2	
$1K-$3K	1	
(Demolition Cost/O&M Cost)		
5 years and below	5	**100**
5.01 - 10 years	4	
10.01 - 15 years	3	
15.01 - 20 years	2	
20.01 - 25 years	1	
25+ years	0	

Energy Savings Investments Program: The overarching objective of the Energy Savings Investments Program is to implement energy projects focused on improving systems efficiencies and reducing utilities expenditures. The projects that comprise this program are of the highest priority based on expected return on investment or contribution to Federal energy mandates.

Energy Savings Investments Prioritization Process: Energy project prioritization is part of a two-year energy planning/execution process that consists of the following three steps:

1. *Data Call* – Centers submit energy project proposals in the FRED facilities management database.

2. *Data Validation* – FRED reviews proposals and resolves any data integrity issues with Centers.

3. *Prioritization* – FRED prioritizes and programs projects to anticipated budgets in collaboration with the NASA Energy Efficiency Panel. Factors considered include investment amount, estimated annual energy/water use avoidance, dollars invested per million Btu energy avoided, dollars invested per thousand gallons water avoided, estimated annual energy/water and other related cost avoidance, means of executing project, means of establishing baseline consumption and quantifying/verifying actual avoidance, and contribution to whole-building performance.

Programmatic CoF Program. The overarching objective of the Programmatic CoF Program is to undertake construction projects (e.g., new real property assets, additional capacities/capabilities, major repairs/modifications) that are required specifically for the execution of MD programs and/or projects. It also covers demolition of "offset" real property assets for any Program Direct constructed real property asset to ensure compliance with the Reduce the Footprint policy. Program documentation guides how MDs submit programmatic CoF to OSI/FRED to be included in the Agency's budget requests. Each MD conducts their own approval processes and timelines for determining what CoF projects will be implemented in any given year. OSI/FRED monitors this process, using required documents to make sure they clearly understand the intent of the projects and to ensure all projects comply with all applicable Agency and Federal policies.

> *In accordance with the Business Services Assessment for Facilities, if a new capability or facility is funded through Programmatic CoF, the LCCA should demonstrate the plan and commitment by the Mission Directorate to fund the continued operations and maintenance of any new facility or capability through its end of life including its disposal through an upfront investment in the offset demolition. The project's LCCA must also include the estimate and fund sources for all corollary investments such as outfitting, generators, ground support equipment, special test equipment etc. and the fund source for their continued maintenance and operations. The relevant demolition offset for additions or new construction projects shall be costed within the project and submitted in the budget narrative and be considered in the LCCA calculations*.[38]

Prioritization of programmatic projects happens at the program level. Projects are already prioritized and approved by the programs before they are submitted to FRED for inclusion in the CoF program.

Programmatic CoF Submission Process:

1. *Data Call:* The annual data call for program direct projects is initiated by Headquarters/OSI/FRED every year through the Strategic Programming Guidance (SPG) and the Program Resource Guidance (PRG) budget

[38] Program Resources Guidance

process. The data call allows mission directorates to submit program direct projects that will be included in the Agency's budget request. MDs' projects should be consistent with mission goals, the CMP, and reduce the footprint plan. For both discrete (facility project cost estimate of $10 million or more) and minor (facility project cost estimate of more than $1 million but less than $10 million) projects, OSI/FRED requires the following supporting documents:

a. Quad Chart.

b. Congressional Budget Narrative.

c. LifeCycle Cost Analysis (LCCA). OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," NPR 8820, and NASA Space Flight Program and Project Management Handbook require an LCCA for all CoF projects. Only LCCA for discrete projects will be submitted to OSI/FRED, others will be kept on file at the Center.

d. Demolition Offsets list, Demolition Approval Letter, and HUD Documentation if the project requires demolition of existing facility/ies.

2. *Project Briefing:* Before OSI/FRED includes a candidate project in the budget request, a project briefing by the MD will be given to OSI/FRED. The purpose of the briefing is for OSI/FRED to have a clearer understanding of the project intent, cost estimate, scope and procurement strategy, and to review the accuracy and completeness of the documents submitted.

3. *Post-Budget Submittal Actions*: After submission, the Center CoF Program Manager enters all submitted projects in the FRED facilities management database, starts the design procurement process as soon as the design funds are received, and keeps the Headquarters Program Direct CoF Program Manager updated of the design progress and significant design issues (potential increase in estimated cost, change of scope, design schedule change, for example). The Program Manager also assists the Headquarters Program Direct CoF Program Manager in preparing MSC approval packages for projects with estimated construction costs of greater than $20 million. The OSI/FRED/Program Direct CoF Program Manager supports design requirements and prepares packages for and seeks MSC approval of projects with an estimated construction cost of greater than $20 million.

4. *Category C (Cat C) Program Direct Projects:* NPR 8820 defines Cat C projects as "projects requesting funds that had not been part of the President's Budget." Because of their emergent nature, these projects did not go through the normal approval process in the PPBE budget submittal.

a. Before any Cat C project is approved for execution, OSI/FRED requires to receive all documentation described in Step 1 above. In the Congressional Budget Narrative, the following additional explanation/justification is required:

- Why the project was not included in the previous budget requests.
- Potential risks to mission if this project is not performed.
- Funding source (funding year, projects cancelled/swapped, etc.).
- If project is to be funded via Operational Plan (Op Plan) change, submit standard language for Op Plan change.

Lease Program. In accordance with the 51 USC §20113 and §20145, NASA is authorized to out-lease underutilized, NASA-held real property. Title 51 also authorizes NASA to enter into other agreements with external entities, both private and public. Similarly, 54 USC §306121 authorizes NASA to lease Agency historic real properties via the National Historic Preservation Act (NHPA). NASA's authorities allow the Agency to commit to collaborative endeavors that may include the use of NASA facilities and land by the other entities during the terms of the agreement.

The Centers must ensure that each lease complies with 14CFR1204.504. The CFR requires:

- Interest to be granted is not required for a NASA program.
- Lease will have no negative impact to NASA's mission.
- Rights granted in the lease will not interfere with NASA operations.
- Fair value is received by NASA on behalf of the Government as consideration.

The Center must include language in the lease that protects the interest of the Government. This includes adequate termination language.

EULs, as well as, leases authorized by the NHPA provide the Agency a unique opportunity to preserve specialized, expensive, and historic assets that are not currently being fully utilized by NASA's mission and retain the lease proceeds for use on other NASA infrastructure.

In accordance with Title 51, distribution of proceeds from EULs are between the Center (65 percent) and the Agency (35 percent). HQ manages all the proceeds and their distribution. The Agency (35 percent) proceeds fund energy/sustainability upgrades at any Center; in FY 2018, NASA initiated an Existing Building Commissioning Program using this fund source. The Center (65 percent) proceeds fund the generating Center local facility management activity (other than operations), but still require Headquarters approval prior to distribution. The Agency must use NHPA proceeds on identified historic properties or districts, and the proceeds are managed through the CECR account.

The process for Centers to obtain funding for Center level projects is similar to the CoF process outlined above but does not have a minimum request requirement.

APPENDIX B: 2019-2020 FACILITY OVERVIEW DATA

2020 NASA Managed									
		TOTAL	TOTAL	TOTAL	Owned		Leased		Other	
		Measurement	Count	Book Value	s.f.	#	s.f.	#	s.f.	#
Land (acres)		364,516	112	$ 123,306,103	133,037	37	136,184	43	95,295	32
Buildings		46,032,952	2650	$ 7,630,556,145	44,999,706	2551	909,636	28	123,610	71
	Office	10,443,959	319	$ 1,278,809,913	10,207,434	298	232,669	17	3,856	4
	Warehouse	4,124,448	746	$ 264,352,366	4,072,950	721	-	4	51,498	21
	Other	31,464,545	1585	$ 6,087,393,865	30,719,322	1532	676,967	7	68,256	46
Structure		37,383,485	2694	$ 4,864,586,949	37,166,371	2592	106,819	7	110,295	95
	TOTALS	**83,780,953**	**5,456**	**$ 12,618,449,197**	**82,299,114**	**5,180**	**1,152,639**	**78**	**329,200**	**198**