

# NASA Federal Source Code Framework Document for OMB M-16-21

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# Introduction

Effective August 8, 2016, memorandum M-16-21, *Federal Source Code Policy: Achieving Efficiency, Transparency, and Innovation through Reusable and Open Source Software*<sup>1</sup> was released by OMB (Office of Management and Budget).

M-16-21 seeks to ensure that new custom-developed federal source code be made broadly available for reuse across the federal government. This approach is consistent with the Digital Government Strategy “Shared Platform” approach, which enables federal employees to work together—both within and across agencies—to reduce costs, streamline development, apply uniform standards, and ensure consistency in creating and delivering information. The policies in this document do not apply retroactively. M-16-21 aims to:

- Provide a policy to agencies on considerations that must be made prior to acquiring any custom-developed code
- Require agencies to obtain appropriate government data rights to custom-developed code, including at a minimum, rights to government-wide reuse and rights to modify the code. Agencies shall make such custom-developed code broadly available across the federal government, subject to limited exceptions
- Require agencies to consider the value of publishing custom code as open source software
- Establish requirements for releasing custom-developed source code, including securing the rights necessary to make some custom-developed code releasable to the public as open source software under this policy's new pilot program
- Provide instructions and resources to facilitate implementation of this policy

As an agency, NASA is a leader across the federal government in sharing its software. Prior to release of OMB M-16-21, NASA had an active and effective software release program and is an early-adopter of open source principles. Since 2011 NASA has historically released over 20% of software as open source annually.

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<sup>1</sup> Federal Source Code Policy - <https://sourcecode.cio.gov/>

# Federal Code Sharing Process Goals

The long-term goal of addressing and fulfilling OMB M-16-21 within NASA will be to document the official NASA policy in accordance with M-16-21 in a NASA Interim Directive (NID) and supplement the NID with an implementation handbook. In order to meet the November 6th, 2016 OMB Milestone 1 deliverable, NASA will publish an Office Chief Information Officer (OCIO) memo on M-16-21 on the agency's Digital Strategy webpage along with this document.

This document aims to do the following:

- State each M-16-21 objective OMB mandates on NASA
- For each M-16-21 objective, reference an existing NASA policy and/or convey a new policy NASA will create to address the mandate
- Document how NASA will implement the policy

## NASA Policy Objectives

OMB M-16-21 requires Federal Agencies to document both the policy and implementation approach for each of the following objectives:

1. Inventory/Publish Code Project Metadata
2. Implement an Open Source Pilot Program/Government-wide Reuse
3. Incorporate/Apply the 3-Step Software Solutions Analysis
4. Obtain Appropriate Government Rights in Custom-Developed Code
5. Document Exceptions for Code Release

# Inventory/Publish Code Project Metadata

## Background

As required by OMB M-16-21, NASA is required to post a machine-readable code inventory that conforms to the code.json schema<sup>2</sup> cataloging metadata of code projects.

## Existing Policy

Currently no NASA policy exists requiring the agency to explicitly inventory or publish a machine-readable code inventory.

## New Policy

NASA will inventory and publish a machine-readable code project inventory when new code becomes available.

## Implementation

NASA currently provides a listing of all NASA released software (binaries and zipped/archived) on [software.nasa.gov](https://software.nasa.gov) in a human readable catalog. For Open Source specifically, NASA maintains a catalog of code-level projects on [code.nasa.gov](https://code.nasa.gov)<sup>3</sup> that disseminate code projects at the code repository level. The [code.nasa.gov](https://code.nasa.gov) site offers users the ability to search for open source code projects by keyword and the site is powered by a community-maintained metadata catalog hosted on [GitHub.com](https://github.com)<sup>4</sup>. This open source machine-readable catalog will feed a majority of the agency's initial dataset instances for formulation of the code.json inventory. As the code.gov metadata schema is currently being designed, NASA will transform its current Open Source Catalog to be compliant with the OMB format per guidance by the General Services Administration (GSA) code.gov team. The code.json file will be created conforming to the code.json schema maintained by the code.gov community and led by 18F/GSA and will be updated quarterly to reflect new software activities.

Although NASA maintains an internal catalog of software projects, this catalog is sometimes incomplete as existing internal NASA software projects are not disclosed to the Software Release Authority (SRA) catalog. To address this issue and to boost internal software reuse, NASA OCIO, in coordination with Office of Chief Engineer (OCE), has implemented a Federated Code Sharing system that will be used internally to maintain a dynamic inventory of code projects, improve code reuse inside of NASA and automate software disclosure .

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<sup>2</sup> Code.json Schema - <https://github.com/presidential-innovation-fellows/code-gov-web/issues/44>

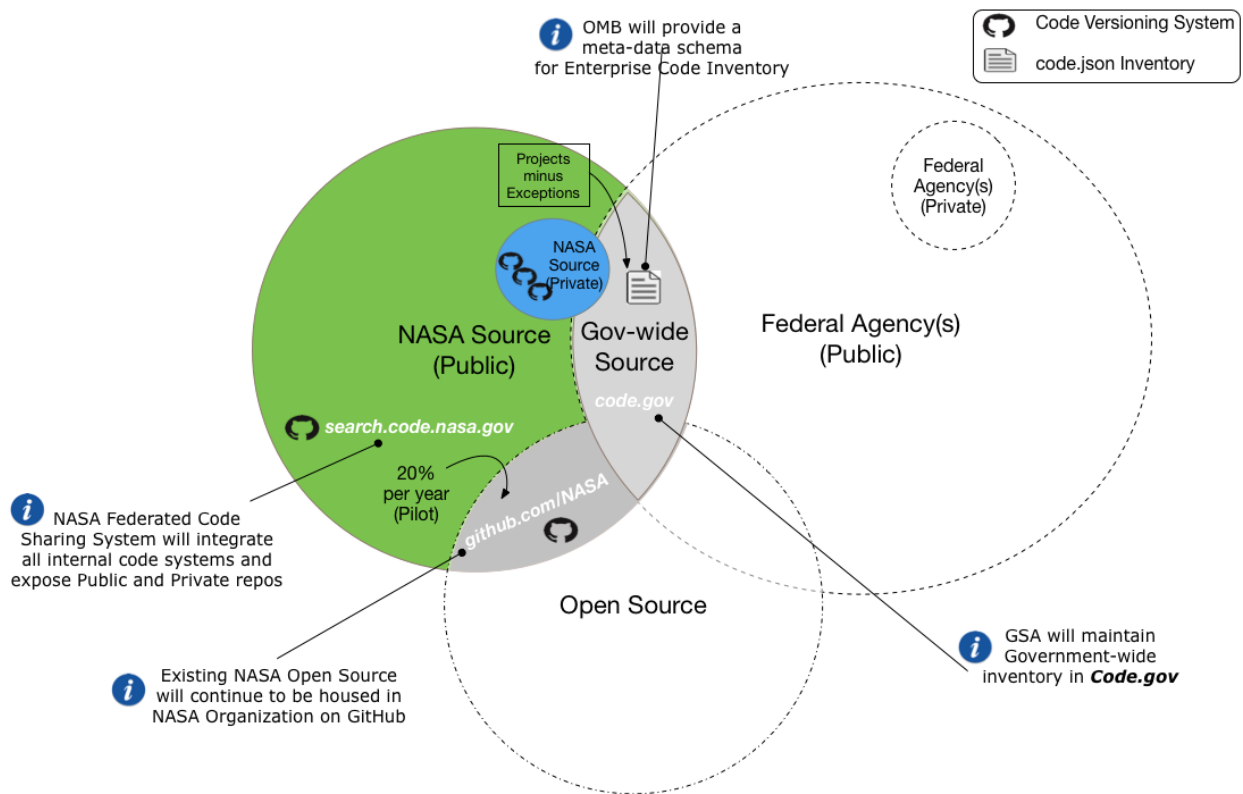
<sup>3</sup> NASA Open Source Catalog - <https://code.nasa.gov/>

<sup>4</sup> Machine Readable/Community Driven Catalog - <https://github.com/nasa/Open-Source-Catalog>

The code.json file location will be posted publicly at [code.nasa.gov/code.json](http://code.nasa.gov/code.json) and will include at a minimum instances for the following:

- All NASA Open Source Software projects released to date
- All NASA Public software projects identified in Federated Code Sharing effort
- All NASA Public and Private software projects that began in fiscal year 2017 and beyond

Since the NASA software development ecosystem currently includes both open source and internal software activities, it is important to note the relationship between NASA Private and NASA Public source code and how it will interact with the overall code inventory.



Big Picture of NASA Source with respect to Code Inventory

The publishing of the code inventory will be complete on December 6, 2016 to meet the 120-day milestone as outlined in OMB's M-16-21.

# Implement an Open Source Pilot Program / Government-wide Reuse

## Background

As required by OMB M-16-21, NASA shall create an Open Source Pilot Program which requires at least 20% of custom-developed code be released as Open Source Software each year for a total of 3 years. Additionally, NASA shall make custom-developed code broadly available across the Federal Government, subject to limited exceptions as documented in *Document Exceptions for Code Release* found below.

## Existing Policy

NASA Procedural Document 2210.1C<sup>5</sup> currently details how NASA shall release Open Source software (NASA Procedural Requirement or NPR 2210.1C section 3.2.1 and 3.2.2) and additionally states software should be released to the greatest extent possible and to the widest audience possible (NPR 2210.1C section 3.1.4). This document also contains policy on Government-wide code release (NPR 2210.1C section 3.2.5).

## New Policy

NASA will release a minimum of 20% of custom-developed code as Open Source Software each year based on the total number of code projects in the code inventory.

## Implementation

NASA has a long tradition of releasing NASA code as open source software. In 2002, NASA formed an Open Source Legal Team that currently has bi-weekly meetings on open source topics. The NASA Procedural Requirements document NPR 2210.1C establishes procedures and responsibilities for the reporting, review, assessment, and release of software created by, or for, NASA. These procedures ensure that NASA software is reported and released according to law and NASA policies, with appropriate restrictions on the use and redistribution of the software. The software release process is managed by the NASA Headquarters Program Executive for Technology Transfer and policy implementation is carried out by the Software Release Authority Working Group (SRAWG), which along with the Office of General Counsel will be key players for implementation of OMB M-16-21 within NASA in cooperation with OCIO. Software Release reviews is performed at the nine NASA Field Centers by Center Software Release Authorities (SRAs).

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<sup>5</sup> [http://nodis3.gsfc.nasa.gov/npg\\_img/N\\_PR\\_2210\\_001C\\_/N\\_PR\\_2210\\_001C\\_.pdf](http://nodis3.gsfc.nasa.gov/npg_img/N_PR_2210_001C_/N_PR_2210_001C_.pdf)

Additionally, NASA is working toward designing and adopting a “develop-in-the-open” process to leverage the power of open source communities and crowdsourcing efforts as this can be appropriate in some circumstances once legal hurdles are addressed, including fiscal law.

## Open Source Repositories

Upon the SRA approval to release an open source project, the SRA and code project owners interface with the NASA OCIO to set up an internet-visible public code repository for release of the code project. NASA requires code developed under this policy to be delivered to a publicly accessible repository hosting service or set of integrated services that are widely recognized by a large, active open source community, widely used by developers. Such integrated services should meet the following criteria:

- Common communication features
- WIKI and/or Static Website/Templating for Documentation
- Issue tracking for bug reports and feature requests
- Version control system
- Source code repositories and repository browsing tools

NASA maintains most open source code projects on [GitHub.com/nasa](https://github.com/nasa)<sup>6</sup>. Although there are other legacy repository locations such as NASA web servers (e.g.: <https://ti.arc.nasa.gov/opensource/projects/> ) and sites like [SourceForge](https://sourceforge.net/projects/coreflightexec/) (e.g.: <https://sourceforge.net/projects/coreflightexec/> ), the majority of code projects released to date are housed within the NASA section of GitHub.com (inside the NASA organization) and administration is led by the NASA OCIO. For an exhaustive list of open source projects and their respected locations, please visit [code.nasa.gov](https://code.nasa.gov) or inspect the Open Source catalog (<https://github.com/nasa/Open-Source-Catalog>) for specific details.

## Software Release Authority

NASA’s software release process is one of the best in the federal government and something should hold up as a gold standard. Each NASA field center has a dedicated Center SRA who is responsible for ensuring that all releases of software are accomplished in accordance with NPR 2210.1C. The NASA SRAWG has implemented an open source release policy consistent with NPR 2210.1C and aims to encourage the broadest appropriate dissemination of NASA software as possible (section 1.1.2)<sup>7</sup>. A listing of Center SRA points of contact can be viewed on [code.nasa.gov](https://code.nasa.gov).

## Licenses

The Agency Counsel for Intellectual Property (ACIP) located in the NASA Office of General Counsel, or designee, is responsible for establishing and maintaining consistency for legal implementation of software release policy for the Agency. This includes release of OSS as well

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<sup>6</sup> <https://github.com/nasa>

<sup>7</sup> [http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal\\_ID=N\\_PR\\_2210\\_001C\\_&page\\_name=Chapter1](http://nodis3.gsfc.nasa.gov/displayDir.cfm?Internal_ID=N_PR_2210_001C_&page_name=Chapter1)

as various other types of software releases, which are provided under the Agency’s Model Software Usage Agreements (SUAs), the legal instruments employed in releasing non-open source NASA software. The vast majority of NASA OSS is currently released under the terms of the NASA Open Source Agreement (NOSA), which was produced by the Agency Open Source Legal Team more than 10 years ago.

Third-party OSS is generally released under the terms of dozens of different open source licenses. As open source software is typically produced by coders who use other preexisting OSS code, license compatibility between the various code licenses becomes a significant issue. The terms of one license may not be compatible with the terms of others. For example, most of the Free Software Foundation’s General Public Licenses (GPL) require that all software derivative work improvements be released under the GPL license—a “copyleft” license. Other licenses also requiring that derivative works be released under their license terms are therefore not compatible with the terms of the GPL license. Reviewing license compatibility for NASA code that incorporates a substantial amount of code under several different OSS licenses is time consuming and labor intensive. Legal review of OSS licenses is performed by NASA Field Center patent attorneys.

As part of implementing M-16-21, the OCIO will work with the ACIP, or designees, to identify, approve and document OSS licenses that can be readily incorporated into NASA OSS projects to facilitate its expeditious release in an open source manner. Permissive licenses guarantee the free use, modification and redistribution of software while still permitting proprietary derivative works, therefore NASA software development processes should strongly encourage the use of pre-approved OSS licenses. Permissive licenses having broad community acceptance include Apache 2.0 License<sup>8</sup>, BSD 3-Clause “Revised” License<sup>9</sup>, and the MIT License<sup>10</sup>. Although NASA encourages the use of incoming OSS under Permissive licenses, as mentioned above, NASA currently releases the majority of its OSS under NOSA version 1.3, which like Apache 2.0 is also considered a “copyleft” license. NOSA v1.3 differs from Apache License 2.0 in that it addresses U.S. Government employee civil servant authored works by establishing that the Government is a 3rd party beneficiary of downstream recipients.

## Areas NASA Will Explore to Increase Frequency of OSS Release

As stated earlier, NASA has a robust software release practice that includes a significant amount of Open Source Software. However, NASA will ensure that it complies with the OMB requirement of 20% by exploring ways to increase the amount of OSS release, if necessary. For example, NASA may consider making software release a requirement for the developers and also reinforce software disclosure requirements. To accomplish this, NASA could consider making software release a requirement for the developers and also reinforce software disclosure requirements. NASA could modify the agency software development policy, NPR

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<sup>8</sup> <https://opensource.org/licenses/Apache-2.0>

<sup>9</sup> <https://opensource.org/licenses/BSD-3-Clause>

<sup>10</sup> <https://opensource.org/licenses/MIT>



7150.2, as well documents NPR 7120.5 and NPR 7120.8 by putting these requirements into program and project plans. It should be noted that before making any proposed change, NASA would need broad concurrence across the agency, which includes but is not limited to OCE, Mission Directorates and Field Centers.

# Incorporate/Apply the 3-Step Software Solutions Analysis

## Background

As required by OMB M-16-21, NASA is required to conduct a 3-Step Software Solutions Analysis as outlined in the Federal Source Code Policy guidance document<sup>11</sup>. The 3-Step Software Solutions Analysis requires NASA to first consider available Open Source solutions prior to any custom-code development. If a suitable Open Source software solution is not available, NASA should next consider the use of COTS before custom-developed code is considered.

## Existing Policy

NASA already has a policy in place to address a variation of the 3-Step Software Solutions Analysis. In NPR 7150.2 section 3.9, Use of Commercial, Government, Legacy, Heritage, and Modified Off-the-Shelf Software, section 3.12 Software Acquisition, section 3.14 Software Reuse and section 3.15 Open Source all detail the policy on use of existing Open Source and COTS prior to custom-developed code.

## New Policy

NASA OCIO shall work on amending NPR 7150.2 to explicitly name the 3-Step Software Solutions Analysis and, to clarify the order of applicability of the aforementioned sections in the existing policy such that Open Source is considered first prior to COTS.

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<sup>11</sup> <https://sourcecode.cio.gov/Three-Step-Software-Solutions-Analysis/>

# Obtain Appropriate Government Rights to Custom-Developed Code

## Background

OMB M-16-21 requires NASA to obtain appropriate Government data rights to custom-developed code. OMB and Code.gov will provide model contract language that NASA can leverage.

## Existing Policy

NASA typically uses standard Federal Acquisition Regulations (FAR) and NASA FAR Supplement clauses to define what intellectual property (IP) rights, including both data and patent rights, the Federal Government obtains in custom-developed code. In addition, NASA has developed local Open Source clauses for use in procurements to address up front any expected use of background OSS as well as any known OSS release goals for software that will be further developed under NASA Government funding. These clauses raise the issue of OSS license compatibility and raise awareness to contractors of NASA OSS release goals.

## New Policy

NASA will implement a new policy that will ensure NASA receives sufficient rights to custom-developed code, so as to accomplish the goals of OMB M-16-21. Until an agency-wide NASA FAR Supplement clause can be produced and implemented, and/or Government-wide clauses are developed, the above-mentioned local Open Source clauses can be modified to address that under OMB M-16-21, NASA is required to release at least 20 percent of custom-developed software as OSS.

## Implementation

NASA will continue to work on this objective at which point in the future that OMB releases contract language and specifics on how to apply them. Additionally, NASA will work with OMB to address Bayh-Dole<sup>12</sup> rights and request additional guidance from OMB.

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<sup>12</sup> [https://en.wikipedia.org/wiki/Bayh%E2%80%93Dole\\_Act](https://en.wikipedia.org/wiki/Bayh%E2%80%93Dole_Act)

# Document Exceptions for Code Release

## Background

OMB M-16-21 exceptions may be applied, in specific instances, to exempt an agency from sharing custom-developed code with other Government agencies. These same exceptions would also prevent open source release of certain software. Any exceptions used must be approved and documented by NASA OCIO for the purposes of ensuring effective oversight and management of information technology resources.

## Existing Policy

NASA Procedural Document 2210.1C currently documents the NASA policy on software exceptions in great detail.

## New Policy

No new policy is required as this objective is documented in NPR 2210.1C.

## Implementation

NASA OCIO is responsible for ensuring effective oversight and applying exemptions to government code reuse per M-16-21. Working in conjunction with the Agency Applications Office (AAO), NASA shall use “best-practices” for setting up software repository structures that allow a clean separation of modules that can and should be individually released for greater dissemination. This repository architecture will allow code that falls into an excepted area to be individually scrutinized by the SRAWG. The following exceptions and considerations are part of the agency’s policy:

- Source code is restricted by law or regulation
- Intellectual Property Law (e.g. Patent Law)
- Export Asset Regulations
- International Traffic in Arms Regulation
- Federal laws and regulations governing classified information
- Source code would create an identifiable risk
- Source code release contributes to the detriment of national security, confidentiality of government information, or individual privacy
- Stability, security, or integrity of the agency’s systems or personnel
- To agency mission, programs, or operations
- Agency CIO believes it is in the national interest to exempt sharing the source code
- The release of the code would interfere with or restrict the assertion of patent rights by the Government and/or its contractors
- The release of the code is restricted due to third party rights in the code

- The code is the subject of other agency technology transfer efforts aimed at making the code available to the public

# Acronyms

ACIP	Agency Counsel for Intellectual Property
API	Application Programming Interface
FAR	Federal Acquisition Regulations
GSA	General Services Administration
HQ	NASA Headquarters
M-16-21	Presidential Memorandum: Federal Source Code Policy
NASA	National Aeronautics and Space Administration
NID	NASA Interim Directive
NOSA	NASA Open Source Agreement
NPR	NASA Procedural Requirement
OCE	Office of Chief Engineer
OCIO	Office Chief Information Officer
OMB	Office of Management and Budget
OSS	Open Source Software
SRA	Software Release Authority
SRAWG	Software Release Authority Working Group
SUA	Software Usage Agreement

# Definitions

code.nasa.gov	The authoritative site for NASA Open Source Code Projects
code.gov	This platform is primarily intended to serve two distinct functions. First, it will act as an online collection of tools, guides, and best practices specifically designed to help agencies implement the framework presented in this policy. Second, it will serve as the primary discoverability portal for custom-developed code intended both for Government-wide reuse and for potential release as Open Source Software (OSS). Code.gov is not intended to house the custom-developed code itself; rather, it is intended to serve as a tool for discovering custom-developed code that may be available for Government-wide reuse or as OSS, and to provide transparency into custom-developed code that is developed using Federal funds. This discoverability portal will be publically accessible and searchable via a variety of fields and constraints, such as the name of the project, its intended use, and the agency releasing the source code. Code.gov will be accessible at <a href="https://www.code.gov">https://www.code.gov</a> and will evolve over time as a community resource to facilitate the adoption of good custom source code development, sharing, and reuse practices.
Custom-Developed Code	For the purposes of this policy, custom-developed code is code that is first produced in the performance of a Federal contract or is otherwise fully funded by the Federal Government. It includes code, or segregable portions of code, for which the Government could obtain unlimited rights under Federal Acquisition Regulations (FAR) Pt. 27 and relevant agency FAR Supplements. Custom-developed code also includes code developed by agency employees as part of their official duties. For the purposes of this policy, custom-developed code may include, but is not limited to, code written for software projects, modules, plugins, scripts, middleware, and Application Programming Interfaces (APIs); it does not, however, include code that is truly exploratory or disposable in nature, such as that written by a developer experimenting with a new language or library.
NASA Private	Source code that is not visible to NASA.gov intranet users and requires explicit "Read" permissions to a code repository.
NASA Public	Source code that is set with an access control of "anonymous Read", meaning the code repository is viewable inside of NASA without requiring explicit authentication and can be cloned, forked or reused freely within the agency.
M-16-21	Presidential Memorandum: Federal Source Code Policy

Metadata	A set of data that describes and gives information about other data
Open Source Software	Software that can be accessed, used, modified, and shared by anyone. OSS is often distributed under licenses that comply with the definition of “Open Source” provided by the Open Source Initiative ( <a href="https://opensource.org/osd">https://opensource.org/osd</a> ) and/or that meet the definition of “Free Software” provided by the Free Software Foundation ( <a href="https://www.gnu.org/philosophy/free-sw.html">https://www.gnu.org/philosophy/free-sw.html</a> ).
Permissive Licenses	A permissive license is a software license that guarantees the ability to use, modify, and redistribute the software, as long as attribution back to the original developers is provided.
Source Code	Computer commands written in a computer programming language that is meant to be read by people. Generally, source code is a higher level representation of computer commands as they are written by people and, therefore, must be assembled or compiled before a computer can execute the code as a program.