

## IMPLEMENTATION OF CROSS-AGENCY NUCLEAR APPLICATIONS

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*The Radioisotope Power System (RPS) Program was established in 2009 to manage RPS investments for NASA to ensure the availability of RPS for the exploration of the solar system in environments where conventional solar or chemical power generation is impractical or impossible. The RPS Program is a multi-center and multi-agency program. NASA is in partnership with the Department of Energy (DOE) Office of Nuclear Energy to provide technologically robust nuclear power system solutions to robotic spacecraft and exploration missions.*

*During the last decade, the RPS Program and DOE have supported missions, developed technologies and initiated new power system developments. These technical areas, as all technical areas, have challenges and standard engineering solutions; however, clearing the path to enable the technical work requires agreements to be established. This paper describes a process by which two governmental agencies have established a successful basis to accomplish the needed work.*

### I. RPS BACKGROUND

The NASA Radioisotope Power Systems (RPS) Program's goal is to make RPS available for the exploration of the solar system in environments where conventional solar or chemical power generation is impractical or impossible to use to meet mission needs. To meet this goal, the RPS Program manages investments in RPS system development, RPS technologies, and DOE RPS operations. The RPS Program exists to support NASA's Science Mission Directorate (SMD). The RPS Program provides

- Strategic leadership for RPS
- Enables the availability of RPS for use by the planetary science community
- Successfully executes RPS flight projects and mission deployments
- Maintains a robust technology development portfolio
- Manages RPS related National Environmental Policy Act (NEPA) and Nuclear Launch Safety (NLS) approval processes for SMD

- Maintains insight into the Department of Energy (DOE) implementation of NASA funded operations to produce fuel.
- Develops new systems working with the DOE

The relationship, roles, and responsibilities between NASA and the DOE as it relates to nuclear power activities is documented in an inter-agency Memorandum of Understanding (MOU) signed in October 2016. This MOU is the governing document that provides the basis for the NASA and DOE partnership for nuclear power activities. To provide further specificity to the areas of work performed at DOE that support NASA, an InterAgency Agreement (IAA) is established. Strategic Partnership Plans (SPPs) are also developed to enable direct access to the DOE's Federally Funded Research and Development Centers (FFRDCs). The SPPs establish management parameters for specific investments such as DOE's RPS production operations investments and system development project's contract acquisitions. NASA HQ is responsible for the MOU and IAAs that govern the DOE delivery of RPS services. The RPS Program office supports NASA HQ in the development of these documents. The Program is responsible for the SPPs.

### II. MEMORANDUM OF UNDERSTANDING

Memorandums of Understanding have existed for the last 50 years between NASA and DOE. In 1965, and MOU was established entitled "1965 IAA Between the Atomic Energy Commission (AEC) and the National Aeronautics and Space Administration Concerning Isotopic SNAP Devices for NASA Space Vehicles".<sup>1</sup> This MOU delineated the authorities and responsibilities of the AEC and NASA in the areas of research, technology development, space vehicle integration, and launch phases. This was with respect to certain isotopic Systems for Nuclear Auxiliary Power (SNAP) devices. This agreement had 13 different supplements or IAAs in today's terminology, which codified specific activities.

In 1991, NASA and the Department of Energy established a subsequent Memorandum of Understanding entitled "1991 MOU Between DOE and NASA Concerning Radioisotope Power Systems for Space

Missions”.<sup>2</sup> Again, this MOU’s purpose was to delineate the authorities and responsibilities of the Department of Energy (DOE) and the National Aeronautics and Space Administration (NASA) in research, technology development, design, production, delivery, space vehicle integration and launch phases with respect to certain radioisotope power systems. This agreement called out specifically Radioisotope Thermoelectric Generators (RTGs) and Radioisotope Heater Units (RHUs). This agreement had eight different supplements.

In 2016, NASA and DOE entered into a new MOU<sup>3</sup>. This MOU was entitled “2016 MOU Between NASA and DOE Concerning Radioisotope Power Systems”. This MOU revalidated and updated the 1991 MOU extending the agreement to cover other nuclear power systems, such as fission-based systems. DOE classifies all fission systems, whether used to produce power for electricity or thermal energy for propulsion as a nuclear power system. The term of the 2016 MOU is 10 years, but it can be revised or extended at the mutual agreement of NASA and DOE.

These MOUs are entered into agreement in accordance with the National Aeronautics and Space Act, 51 U.S.C. § 20101, et seq and the Atomic Energy Act of 1954 as amended, 42 U.S.C. § 2011, et seq and the Department of Energy Organization Act, 42 U.S.C. § 7101, et seq. These U.S. codes establish the authorities of NASA and DOE. DOE has been given the authority, under United States federal law, and the responsibility for both civilian and military uses of nuclear materials. This includes the development, regulation, and disposal of nuclear materials and facilities in the United States. The National Aeronautics and Space Act established NASA to conduct aeronautical and space activities that contribute materially to multiple objectives including for “the expansion of human knowledge of phenomena in the atmosphere and space”. These MOUs provide the basis for how the Agencies have and will continue to work together in support of science and exploration. These agreements have been signed at the highest levels of each agency, the Secretary of Energy and the NASA Administrator.

### **III. INTERAGENCY AGREEMENTS**

NASA and the DOE utilize IAAs to define work scope and to fund interagency activities. The Financial Management System (FMS) 7600A (IAA Part A) form is written and negotiated by both Agencies. The statement of work associated with the IAA Part A is broad and includes all RPS content at DOE, including production operations called Constant Rate Production (CRP), system developments, system delivery, and support for missions. Typically, the document includes a description of the scope of work to be completed by the Servicing

Agency (which specifies the goods to be furnished or tasks to be accomplished), a set of roles and responsibilities from both the Requesting Agency and the Servicing Agency, and additional clauses that are developed and agreed to by both parties. In this construct, NASA is the requesting agency and DOE is the servicing agency. This initial agreement is signed by both entities prior to initiating the IAA Part B process. Additionally, unless a waiver is granted, an IAA Part A form is valid for 5 years and another Part A will have to be created beyond this period.

The FMS 7600B (IAA Part B) form and its associated statement of work serves as the funding mechanism between the NASA and the DOE for RPS content. It is a subservient document to the IAA Part A. It contains detailed tasks to be accomplished with estimated completion dates, and is completed on an annual basis.

The U.S. Department of the Treasury (DOT) provides reference information to support the download and completion of the IAA forms. Departments and Agencies are encouraged to develop standard Government-wide business practices that are in accordance with DOT financial guidelines.<sup>4</sup>

The RPS Program developed a work instruction to document a set of best practices that has been utilized to streamline the IAA development and funding process.

### **IV. STRATEGIC PARTNERSHIP PLANS**

In addition to the IAA’s, the NASA RPS Program also develops Strategic Partnership Projects (SPP) with the DOE as outlined in DOE Order 481.1D “Strategic Partnership Projects” dated December 5, 2016. SPP provide other federal agencies the ability to utilize the DOE’s unique capabilities and expertise to achieve mission goals and objectives that otherwise are not available through private entities. The RPS Program currently has an SPP with each DOE field organization associated with CRP, and for system developments (e.g., the Next Generation of a Radioisotope Thermoelectric Generator and the enhanced multi-mission radioisotope thermoelectric generator (eMMRTG)) with the Idaho National Laboratory.

### **V. CONCLUSION**

Without emplacing formal interagency agreements and appropriate management structures, RPS projects that enable past, present, and future missions would not be possible. NASA, both at Headquarters and in the RPS Program, have partnered with DOE to ensure the right processes are followed so that existing and newly emerging technologies can be brought forward efficiently and effectively to explore distant destinations of our solar

system. DOE is also ensuring the laboratory capabilities to fuel and deploy radioisotope power systems are maintained, and are ready to support future space exploration.

## **REFERENCES**

1. "1965 IAA Between the Atomic Energy Commission (AEC) and the National Aeronautics and Space Administration Concerning Isotopic SNAP Devices for NASA Space Vehicles." September 1965.
2. "1991 MOU Between DOE and NASA Concerning Radioisotope Power Systems for Space Missions." July 1991.
3. "Memorandum of Understanding between the National Aeronautics and Space Administration and the Department of Energy Concerning Radioisotope Power Systems." October 2016.
4. <http://www.fms.treas.gov/finstandard/reference.html>