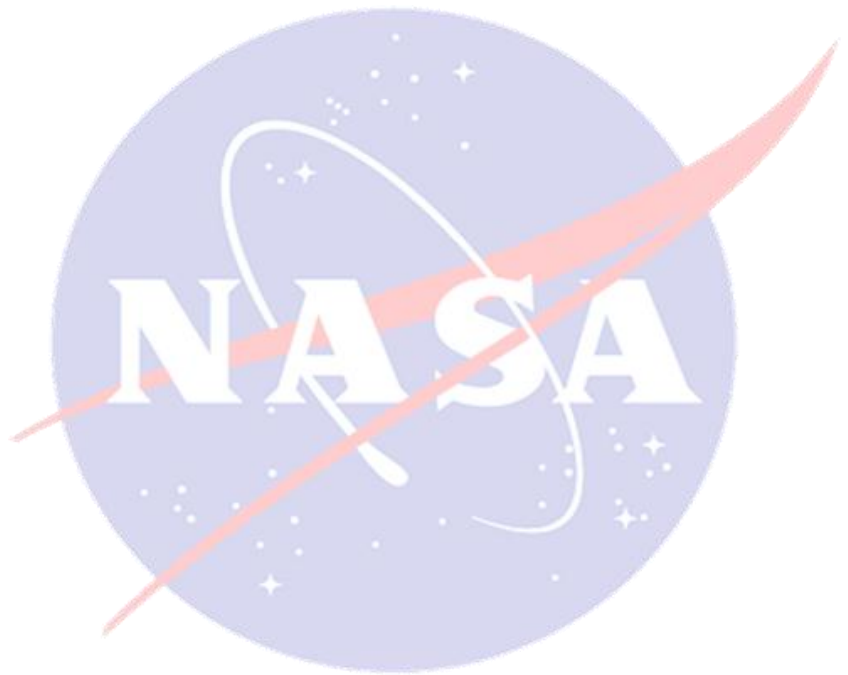




National Aeronautics and Space Administration

**OFFICE OF INSPECTOR GENERAL**

**Audit of NASA's Cooperative  
Agreement with BioServe Space  
Technologies - University of  
Colorado at Boulder**



OFFICE OF AUDITS

AUDIT REPORT  
AUGUST 4, 2014

**IG-14-028**

(A-14-003-00)

Final report released by:

A handwritten signature in black ink, appearing to read 'PKMJA', written in a cursive style.

Paul K. Martin  
Inspector General

## Acronyms

---

GAO	Government Accountability Office
ISS	International Space Station
NPR	NASA Procedural Requirements
OIG	Office of Inspector General
OMB	Office of Management and Budget
PI	Principal Investigator
STS	Space Transportation System

---

---

## OVERVIEW

---

# AUDIT OF NASA'S COOPERATIVE AGREEMENT WITH BIOSERVE SPACE TECHNOLOGIES - UNIVERSITY OF COLORADO AT BOULDER

## The Issue

---

Each year NASA awards grants and cooperative agreements to a variety of educational institutions – for fiscal year 2013, the Agency awarded \$433 million in grants and \$146 million in cooperative agreements. In September 2011, the NASA Office of Inspector General (OIG) reported that NASA did not have an adequate system of controls in place to ensure proper administration and management of the Agency's grant program and, as a result, some grant funds were not used for their intended purposes.<sup>1</sup> As a follow-on to that report, the OIG is conducting a series of audits examining particular NASA grants and cooperative agreements.

In this report, we reviewed an approximately \$3.6 million cooperative agreement NASA awarded to BioServe Space Technologies - University of Colorado at Boulder (BioServe). In April 2010, NASA's Space Operations Mission Directorate issued an announcement soliciting offers and concepts for payload integration and operations services, support equipment, and instrumentation capabilities for utilization of the International Space Station (ISS) National Laboratory (National Lab).<sup>2</sup> In response, BioServe submitted a proposal, and the Agency awarded the University a cooperative agreement – valued at \$600,000 through August 31, 2011 – to conduct research on the National Lab examining the effects of microgravity on the plant species *Jatropha curcas* (Jatropha).<sup>3</sup> Thereafter, NASA modified the agreement to include BioServe providing hardware and payload integration and operations services for the National Lab. Through February 2014, NASA issued 13 modifications to the cooperative agreement and increased the total award to \$3,577,247.<sup>4</sup>

---

<sup>1</sup> NASA OIG, "NASA's Grant Administration and Management" (IG-11-026, September 12, 2011).

<sup>2</sup> The "NASA Authorization Act of 2005," Pub. L. No. 109-155 (2005), designated the U.S. segment of the ISS as the National Lab and directed NASA to increase utilization of the National Lab by other Federal entities and foster commercial interest in conducting research on the ISS.

<sup>3</sup> *Jatropha* is a species of flowering plant native to Mexico and Central America that has a variety of potential uses, including in the production of biofuel and fertilizer.

<sup>4</sup> Modifications 1, 2, 7, 9, and 13 were administrative modifications made to deobligate or reobligate funds, extend periods of performance, and update NASA points of contact, which did not require BioServe to provide new products or services. See Appendix B for a more detailed description of the items and services provided under the cooperative agreement.

Two of these modifications were for the development of a Space Automated Bioproduct Laboratory (bio lab) to enable commercial research and development aboard the ISS and a multi-well plate (multi-well) for research utilizing microorganisms.

- **Modification 6.** *Development of the Space Automated Bioproduct Lab to Enable Commercial Research and Development on Board the International Space Station* – BioServe is building a minimum of four bio lab units designed to eliminate acoustic noise, reduce crew time required for experiment access, be easy to use, and reduce temperature gradients inside of the ISS.
- **Modification 12.** *Development of a Multi-well Plate for Research Utilizing Biosafety Level-2 Microorganisms Analyzed in the Molecular Probes (M5E) Plate Reader on Board the ISS* – BioServe agreed to design, build, and test a 12-well format multi-well plate that can be used for a wide variety of cell culture and microbiology studies on board the ISS. BioServe agreed to deliver 6 engineering units and 30 multi-well plates.

The objective of this audit was to determine whether BioServe used cooperative agreement funds for their intended purpose and whether costs the University claimed were allowable, reasonable, and in accordance with applicable laws, guidelines, and terms and conditions of the cooperative agreement. We also reviewed internal controls related to the administration and management of the agreement. Details of the audit's scope and methodology, our review of internal controls, and a list of prior coverage are in Appendix A.

## Results

---

We found BioServe spent cooperative agreement funds for their intended purposes and identified no questioned costs. However, we identified weaknesses in BioServe and NASA internal controls as they relate to the administration and management of the cooperative agreement. Specifically, BioServe requires an additional \$520,000, or about 36 percent, more than the approved budget in order to complete development, delivery, integration, operations, and launch of the bio lab units and \$75,000, or 15 percent, more to complete the multi-well plates.<sup>5</sup> In addition, current project plans have BioServe delivering the products about 16 and 10 months, respectively, beyond the original schedule. These cost overruns and delays occurred because BioServe and NASA underestimated the complexity of the development effort and failed to identify all technical requirements when negotiating the cooperative agreement and because BioServe did not track and compare actual expenditures to approved project budgets. In our judgment, additional efforts are needed to better identify and price technical requirements and account for costs in this agreement. Failure to address these concerns increases the risk of cost and schedule overruns in the existing and any future cooperative agreements with BioServe.

---

<sup>5</sup> BioServe requires \$220,000 more than its approved budget in order to complete the originally proposed development and delivery of the bio lab units. In addition, BioServe later proposed and NASA approved an additional \$300,000 to complete the required integration and operations and launch of the bio lab unit to the ISS.

## Management Action

---

To reduce the risk of further cost and schedule overruns, we recommended the Associate Administrator for Human Exploration and Operations in coordination with the Assistant Administrator for Procurement ensure NASA and BioServe do a better job identifying and understanding technical requirements when negotiating the cooperative agreement and the Agency improves its process for evaluating proposed costs so that approved budgets better approximate actual expenditures. In addition, we recommended the Associate Administrator require that, for all future awards, BioServe separately account for and report expenditures incurred for each project. Finally, we recommended the Associate Administrator monitor actual performance against the cost and schedule milestones NASA and BioServe negotiated for the remaining deliverables on the bio lab and multi-well projects.

In response to a draft of our report, the Associate Administrator concurred with our recommendations and proposed corrective actions. We consider those actions responsive and will close the recommendations upon completion and verification of the actions. We incorporated management's technical comments on our draft into the final report as appropriate. Management's full response to the draft report is reprinted in Appendix C.



---

---

## CONTENTS

---

### INTRODUCTION

Background	1
Objectives	3

### RESULTS

The Bio Lab and Multi-Well Projects Are Over Budget and Over Schedule	4
---	---

### APPENDIX A

Scope and Methodology	9
Review of Internal Controls	11
Prior Coverage	12

### APPENDIX B

Products and Services Provided by the Cooperative Agreement	14
---	----

### APPENDIX C

Management Comments	16
---------------------	----

### APPENDIX D

Report Distribution	18
---------------------	----





---

---

## INTRODUCTION

---

### Background

Since 1987, BioServe Space Technologies - University of Colorado at Boulder (BioServe) has partnered with NASA, industry, and other organizations to conduct ground- and space-based research to support the development of scientific technologies that both benefit human space exploration and have commercially viable Earth-based applications. Based in the University's College of Engineering and Applied Sciences, BioServe is led by a Director and employs approximately 11 University faculty members assisted by graduate and undergraduate students. Hardware developed by BioServe has supported a wide variety of space life sciences, including molecular processes, cell and tissue culture, and the development and adaptation of various plants and organisms to microgravity. The University has flown payloads on the Space Shuttle, as well as the Russian Progress and Soyuz vehicles, and its payloads have been on the International Space Station (ISS) continuously since 2002.

**Cooperative Agreement.** In April 2010, NASA's Space Operations Mission Directorate issued an announcement soliciting offers and concepts for payload integration and operations services and support equipment and instrumentation capabilities for utilization of the International Space Station (ISS) National Laboratory (National Lab).<sup>6</sup> In response, BioServe submitted a proposal, and the Agency awarded the University a cooperative agreement – valued at \$600,000 through August 31, 2011 to conduct research on the National Lab examining the effects of microgravity on the plant species *Jatropha curcas* (Jatropha).<sup>7</sup> Thereafter, NASA modified the agreement to include BioServe providing hardware and payload integration and operations services for the National Lab. Through February 2014, NASA issued 13 modifications to the cooperative agreement and increased the total award to \$3,577,247.<sup>8</sup> Two of these modifications were for development of a Space Automated Bioproduct Laboratory (bio lab) to enable commercial research and development aboard the ISS and a multi-well plate (multi-well) for research utilizing microorganisms.

---

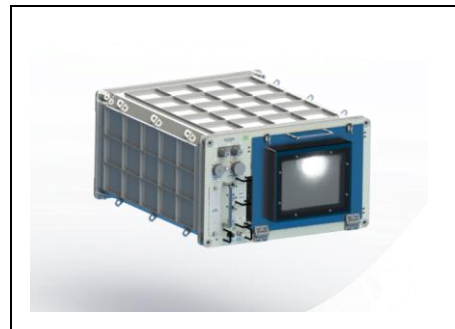
<sup>6</sup> The "NASA Authorization Act of 2005," Pub. L. No. 109-155 (2005) designated the U.S. segment of the ISS as the National Lab and directed NASA to increase utilization of the National Lab by other Federal entities and foster commercial interest in conducting research on the ISS.

<sup>7</sup> *Jatropha* is a species of flowering plant native to Mexico and Central America that has a variety of potential uses, including the production of biofuel and fertilizer.

<sup>8</sup> Modifications 1, 2, 7, 9, and 13 were administrative modifications made to deobligate or reobligate funds, extend periods of performance, and update NASA points of contact and did not require BioServe to provide new products or services. See Appendix B for a more detailed description of the items and services provided under the cooperative agreement.

**Modification 6.** *Development of the Space Automated Bioproduct Lab to Enable Commercial Research and Development on Board the International Space Station* – BioServe is building bio lab units to replace the Commercial Generic Bioprocessing Apparatus, which has a number of drawbacks and was originally designed to operate on the Space Shuttle. The bio lab units are designed to eliminate acoustic noise, reduce crew time required for experiment access, be easy to use, and reduce temperature gradients inside of the ISS. BioServe agreed to build a minimum of three flight units that would be tested and flight certified. In addition, BioServe would build at least one engineering unit for safety, interface, and functional testing, as required. (See Figure 1.)

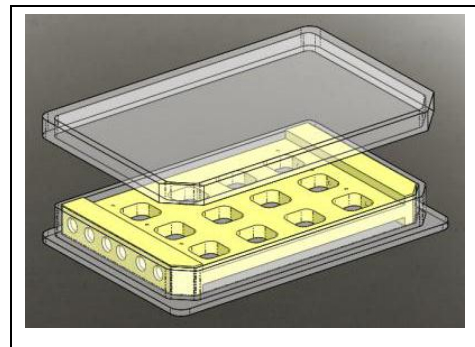
**Figure 1. Bio Lab Unit**



Source: BioServe.

**Modification 12.** *Development of a Multi-well Plate for Research Utilizing Biosafety Level-2 Microorganisms Analyzed in the Molecular Probes (M5E) Plate Reader on Board the ISS* - BioServe agreed to design, build, and test a 12-well format multi-well plate that can be used to enable a wide variety of cell culture and microbiology studies on board the ISS. These studies include vaccine screening, 3-D tissue growth, and cell biology. BioServe agreed to deliver 6 engineering units and 30 plates that could be distributed between flight and ground-control samples, as needed. (See Figure 2.)

**Figure 2. 12-Well Version of the Multi-well Plate**



Source: BioServe.

Pursuant to the cooperative agreement, BioServe was to deliver 3 bio lab flight units and 30 multi-well plates by September 30, 2013, and March 31, 2014, respectively. For a description of the other products and services covered by the cooperative agreement, see Appendix B.

**Administration and Management of the Agreement.** A NASA engineer from the ISS National Lab Office conducted biweekly telephone conference calls with BioServe officials to review the status of hardware and flight experiments, integration and operation issues, and other technical items. In addition, the ISS Program Research Integration Office conducts monthly and quarterly technical, cost, and schedule reviews with BioServe that include in-depth discussions and data highlighting planned versus actual cost reporting and technical issues.

At the beginning of each fiscal year, BioServe provides a plan for spending the allocated budget. Each month, NASA extracts the actual amount paid to BioServe from NASA's

financial system and compares it to the approved budget. NASA requires BioServe to explain any variations that exceed 5 percent. Additionally, NASA conducts hardware and safety reviews of the University's flight experiments. The BioServe Director, who also serves as the Principal Investigator (PI), has primary responsibility for achieving technical success and complying with the financial and administrative policies and regulations associated with the award.

**Project Management.** NASA manages most Agency space flight programs and projects by imposing a series of key decision points designed to keep programs and projects on schedule, control costs, and monitor performance. To move to the next stage of development, a project must pass a review at each of these decision points. The Agency describes this process in NASA Procedural Requirements (NPR) 7120.5E, "NASA Space Flight Program and Project Management Requirements." However, for a variety of reasons NASA has not required ISS payload developers, such as BioServe, to comply with all aspects of the NPR. First, payload developers typically do not have the workforce to support all of the successive reviews at each key decision point, as prescribed by the NPR, and requiring them to increase staff to do so would significantly increase NASA's costs. Second, NASA does not consider the payloads they produce to be mission critical and therefore the payloads need not meet the same standards of reliability and maintainability as systems required for the health and safety of astronauts. Rather than strict adherence to the NPR, NASA chooses specific key decision points for these projects based on their level of complexity.

Pursuant to the cooperative agreement, the key milestones applicable to the bio lab and the multi-well projects are the Preliminary Design and Critical Design reviews. According to NPR 7120.5E, the Preliminary Design Review evaluates the completeness and consistency of a project's preliminary design in meeting all requirements with appropriate margins, acceptable risk, and within cost and schedule constraints, and determines readiness to proceed with the detailed design phase. Critical Design Review determines if the integrated design is appropriately mature to proceed to final design and fabrication. Both the bio lab and multi-well projects passed a Preliminary Design Review in September 2012 and April 2013, respectively. The Critical Design Review for the projects is scheduled for August 2014. In addition, NASA plans to perform a System Acceptance Review for the bio lab project in February 2015.<sup>9</sup>

## Objectives

The objective of this audit was to determine whether BioServe used cooperative agreement funds for their intended purpose and whether the costs that the University claimed were allowable, reasonable, and in accordance with applicable laws, regulations, guidelines, and terms and conditions of the cooperative agreement. We also reviewed internal controls related to the administration and management of the cooperative agreement. See Appendix A for details of the audit's scope and methodology, our review of internal controls, and a list of prior coverage.

---

<sup>9</sup> According to NPR 7120.5E, the purpose of a System Acceptance Review is to evaluate whether a specific end item is sufficiently mature to be shipped from the supplier to the designated operational facility or launch site.

---

---

## THE BIO LAB AND MULTI-WELL PROJECTS ARE OVER BUDGET AND OVER SCHEDULE

---

BioServe requires an additional \$520,000 (about 36 percent) more than its approved budget to complete development, delivery, integration, operations, and launch of the bio lab units, and \$75,000 (15 percent) more for the multi-well plates.<sup>10</sup> In addition, current project plans have BioServe delivering the products 16 and 10 months, respectively, beyond the original schedule. These cost overruns and delays occurred because BioServe and NASA underestimated the complexity of the development effort and failed to identify all technical requirements when negotiating the cooperative agreement and because BioServe did not track and compare actual expenditures to approved project budgets. In our judgment, BioServe and NASA need to better identify and price technical requirements and account for project costs. Failure to address these concerns increases the risk of additional cost and schedule overruns in the existing cooperative agreement and any future agreements with the University.

### **BioServe's Proposals Underestimated Expenditures and Overpromised on Delivery Dates**

BioServe will require \$595,000 and 16 months in addition to what the University proposed and NASA approved to complete the bio lab and multi-well projects. From inception of the cooperative agreement through December 31, 2013, BioServe spent \$3,571,653, or essentially all but \$6,000 of the total funds NASA had obligated to the cooperative agreement.

**The Bio Lab Unit.** BioServe was originally approved to spend \$1.45 million for the bio lab project, but will now require an additional \$520,000 and 16 additional months to complete the work. The PI cited three reasons BioServe did not meet the planned budget and schedule: (1) the original proposal did not include actual manifesting or integration and operations associated with deployment on a specific flight, (2) costs increased due to unanticipated loss of personnel, and (3) BioServe's proposal underestimated the effort needed to complete development.<sup>11</sup>

---

<sup>10</sup> BioServe requires an additional \$220,000 more than its approved budget to complete the originally proposed development and delivery of the bio lab units. In addition, BioServe later proposed and NASA approved an additional \$300,000 to complete the required integration and operations and launch of the bio lab unit to the ISS.

<sup>11</sup> Flight implementation means completing all of the requisite steps (paperwork, process, physical integration, operations planning, and mission execution) to fly, install, and operate a piece of hardware on the ISS.

**The Multi-well Plate.** BioServe was originally approved to spend \$500,000 on the multi-well project, but will now require about \$75,000 more than and an additional 10 months to complete the work. According to the PI, BioServe prepared the proposal for the project in the fall of 2012 with limited knowledge of requirements associated with two key pieces of equipment on the ISS – the Microgravity Science Glovebox and the Disposable Glove Bag, both of which help to prevent liquids and particles used in experiments from floating about the cabin.<sup>12</sup> In addition, fabrication and materials selection have proven more costly than BioServe anticipated.

For their part, Johnson Space Center (Johnson) ISS Program officials stated that both NASA and BioServe contributed to the agreement's cost growth and schedule delays. They indicated NASA added requirements for an on-orbit validation flight for both pieces of hardware, increasing the cost of the hardware. Further, the ISS Program officials stated schedule delays on the bio lab and multi-well projects were also attributable to the Agency's direction to BioServe to give work on a rodent research flight project higher priority. Additionally, they expressed the view that the development of hardware for operation in the harsh environment of space is inherently complex and therefore uncertainties that result in cost and schedule growth are sometimes unavoidable.

**Way Forward.** In June 2014, NASA and the University of Colorado approved a plan pursuant to which BioServe will receive \$595,000 in additional funding from NASA and complete the bio lab and multi-well projects by January 2015. NASA contends that the Agency and BioServe now understand the effort needed to complete the projects and anticipate BioServe will meet the revised budget and schedule. As noted earlier, NASA has chosen to apply only selective tenets of NPR 7120.5E to BioServe's development effort. We acknowledge that imposing all of the life cycle milestones found in the NPR on relatively low-dollar development projects such as these may be impractical. However, we, the Government Accountability Office (GAO), and others have repeatedly reported on the cost and schedule risks associated with projects that proceed to implementation with unproven technologies, inadequate funding, or unstable requirements.<sup>13</sup> In our judgment, the cost increases and schedule delays experienced by BioServe follow a similar pattern.

---

<sup>12</sup> The Microgravity Science Glovebox – one of the major dedicated science facilities inside the ISS's Destiny module – has a large front window and built-in gloves to provide a sealed environment for conducting science and technology experiments. The Disposable Glove Bag is an unpressurized enclosure that keeps liquids and particles from escaping into the cabin.

<sup>13</sup> NASA Office of Inspector General (OIG), "NASA's Challenges to Meeting Cost, Schedule, and Performance Goals" (IG-12-021, September 27, 2012).

## **NASA Approved BioServe’s Proposed Costs with No Changes despite Noted Weaknesses**

NASA approved the proposed costs submitted by BioServe for the basic cooperative agreement and eight modifications with no changes. For example, NASA approved the bio lab proposal without any changes even though Agency evaluators noted several weaknesses in BioServe’s proposal and the Agency held post-evaluation discussions with BioServe concerning these weaknesses. Specifically, with regard to BioServe’s proposal for the bio lab, evaluators noted that (1) total cost was lower than anticipated for three flight units, (2) it was not clear if total cost included launch of the units and any initial on-orbit check, and (3) operations and payload integration costs were not provided. Although the Agency’s concerns regarding these weaknesses may have been alleviated during the post-evaluation discussions, in our judgment, NASA and BioServe should have identified and negotiated all relevant payload costs associated with developing, integrating, launching, and operating the bio lab and multi-well plates on board the ISS National Lab.

## **NASA Cannot Measure How Well BioServe Performed Against Approved Project Budgets**

NASA and BioServe negotiated separate budgets for the basic cooperative agreement and each subsequent modification. However, BioServe has not separately tracked and reported expenditures against the approved budgets as required by governing Federal regulations. Specifically, the Code of Federal Regulations require recipients of Federal funds to maintain financial management systems that provide for (1) accurate, current, and complete disclosure of the financial results of each Federally sponsored project and (2) comparison of outlays with budget amounts for each award.<sup>14</sup> While BioServe worked on a number of separate projects, it charged all expenses to a single overall cooperative agreement number. As a result, BioServe and NASA cannot accurately measure how well BioServe performed against each approved project budget or whether budget overruns were attributable to the bio lab and multi-well projects or to other projects completed under the cooperative agreement.

BioServe acknowledged the University of Colorado’s accounting system has the capability to accumulate, track, and report expenditures for each BioServe project, and both BioServe and NASA agreed that such project cost accounting would provide greater visibility into the reasons for the cost overruns.

---

<sup>14</sup> Title 2, Code of Federal Regulations Part 215.21, “Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations” (Office of Management and Budget [OMB] Circular A-110).

## Conclusion

According to the University, BioServe has a long history of providing NASA with valuable hardware and payload integration and operations support that enable scientific research and experiments conducted during space flight and onboard the ISS. In addition, NASA and BioServe have considerable experience working with the technical requirements and costs associated with providing hardware and payload support to conduct research in space. However, in our judgment, additional efforts are required to better identify and price technical requirements in the early stage of hardware development and track and compare actual expenditures to approved project budgets in order to avoid cost and schedule overruns.

## Recommendations, Management's Response, and Evaluation of Management's Response

We recommended the Associate Administrator for Human Exploration and Operations in coordination with the Assistant Administrator for Procurement:

**Recommendation 1.** Ensure NASA and BioServe better identify and understand technical requirements when negotiating the cooperative agreement and the Agency improves its process of evaluating BioServe's proposed costs so that approved project budgets better approximate actual expenditures.

**Management's Response.** The Associate Administrator concurred with our recommendation, agreeing to implement a process change that will ensure budget and schedule reserve for future projects is identified at the outset. According to the Associate Administrator, this change will allow for fine-tuning of requirements or recovery from anomalies that occur during the development process and for evaluation of any requirements changes to understand their impact on cost and schedule before proceeding. Although the Associate Administrator expects to implement this process change by August 2014, full implementation is contingent upon receipt of a follow-on proposal from the recipient, the timing of which is currently unknown.

**Evaluation of Management's Response.** Management's comments are responsive; therefore, the recommendation is resolved and we will close it upon verification and completion of the proposed corrective actions.

**Recommendation 2.** Require that, for all future awards, BioServe separately account for and report expenditures incurred for each project.

**Management's Response.** The Associate Administrator concurred with our recommendation, stating that BioServe and the University of Colorado Boulder's Office of Contracts and Grants have already agreed to institute separate accounting on a project basis. Consequently, NASA requested closure of this recommendation upon issuance of the final report.

**Evaluation of Management's Response.** Management's comments are responsive. We confirmed the University of Colorado Boulder's Office of Contracts and Grants has implemented separate project accounting which will allow BioServe and NASA to track and compare project costs to related project budgets in order to avoid cost and schedule overruns. Therefore, we have closed this recommendation.

**Recommendation 3.** Monitor actual performance against the cost and schedule milestones NASA and BioServe negotiated for the remaining deliverables on the bio lab and multi-well projects to minimize the risk of further cost and schedule overruns.

**Management's Response.** The Associate Administrator concurred with our recommendation, stating NASA will continue monitoring BioServe's performance during regular Technical, Cost, and Schedule Reviews. In addition, having BioServe separately track costs associated with each project will enhance NASA's ability to provide oversight. This activity is ongoing through the expiration of the current agreement on March 31, 2015.

**Evaluation of Management's Response.** Management's comments are responsive; therefore, the recommendation is resolved and we will close it upon verification and completion of the proposed corrective actions.



## Scope and Methodology

We performed this audit from January 2014 through July 2014, in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Our overall objective was to determine whether BioServe used NASA's cooperative agreement funds for their intended purpose and whether the costs claimed were allowable, reasonable, and in accordance with applicable laws, regulations, guidelines, and terms and conditions of the cooperative agreement. We also reviewed internal controls as they relate to the administration and management of the cooperative agreement.

On January 14, 2014, we sent an audit announcement letter to the Regents of the University of Colorado advising them of our audit objectives, information requirements, and desire to visit their offices in Boulder, Colorado. On January 30, 2014, we held an entrance conference with Johnson ISS technical monitors, procurement support officers, and others with an interest in our audit. From February 10 – 14, 2014, we met in Boulder with BioServe and University of Colorado staff. We judgmentally selected the cooperative agreement awarded to BioServe for substantive testing based on the award dollar value, the number of supplements awarded, and the fact that it was a cooperative agreement awarded to an educational institution. In addition, we selected the BioServe cooperative agreement for audit because the NASA ISS team that made the award is located at Johnson and we had familiarity with BioServe from a previous audit of the ISS.

We identified and reviewed relevant public laws, the Code of Federal Regulations, OMB circulars, NASA policy, and applicable University of Colorado policy and guidance. Specifically, we reviewed:

- Public Law 95-224, "Federal Grant and Cooperative Act of 1977," February 3, 1978
- Public Law 109-155, "NASA Authorization Act of 2005," December 30, 2005
- Title 2, Code of Federal Regulations, Part 215.21, "Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and Other Non-Profit Organizations" (OMB Circular A-110), January 1, 2012

- Title 48, Code of Federal Regulations, Part 1260, “Aeronautics and Space, ‘National Aeronautics and Space Administration,’ ‘Grants and Cooperative Agreements,’” January 1, 1999
- OMB Circular A-21, “Cost Principles for Educational Institutions” (including the Cost Accounting Standards), August 31, 2005
- OMB Circular A-133, “Audits of Institutions of Higher Education and Other Non-Profit Institutions,” June 26, 2007
- NPR 7120.5E, “NASA Space Flight Program and Project Management Requirements,” August 14, 2012
- University of Colorado, “University of Colorado at Boulder Departmental Financial Management Guide, Chapter 14-Sponsored Projects Accounting,” September 2013

We interviewed NASA technical and procurement personnel and the BioServe PI about BioServe’s need for additional funding to complete work on the bio lab and multi-well projects. We also worked with personnel assigned to the University of Colorado’s Sponsored Projects Accounting Department and its Office of Contracts and Grants to obtain documents and conduct detailed testing of selected cooperative agreement expenditure transactions.

In addition to the interviews, we obtained and reviewed relevant documents, including:

1. Background information on BioServe and the projects funded with NASA cooperative agreement funds;
2. NASA’s process for managing BioServe’s cost, technical, and schedule performance;
3. Official cooperative agreement budgets approved by NASA;
4. Detailed accounting records for expenditures charged to the cooperative agreement;
5. Quarterly financial status reports and drawdown requests;
6. Indirect and fringe benefit rates used for the cooperative agreement; and,
7. State of Colorado Statewide Single Audits (A-133 reports) for fiscal years 2010, 2011, and 2012.

We used judgmental sampling to determine if funds were being spent for their intended purposes and costs were allowable. Specifically, we selected 5 of the 72 payments made to BioServe ranging from \$78,557 to \$526,313 for the period November 19, 2010, through January 8, 2014. From the 5 payments, we chose 49 transactions totaling \$300,749 for detailed review and evaluated whether the expenditures were properly recorded and allowable under the laws and terms of the cooperative agreement. Our review included tracing the expenditures through BioServe’s accounting records to the supporting source documents.

**Use of Computer-Processed Data.** We used computer-processed data from the Department of Health and Human Services Payment Management System to obtain cooperative agreement drawdown and expenditure data for BioServe. Additionally, we used computer-processed data extracted from the University of Colorado at Boulder's accounting system to determine the expenditure transactions charged to the cooperative agreement. Although we did not independently verify the reliability of all this information, we compared it with other available supporting documents to determine data consistency and reasonableness. From these efforts, we believe the information we obtained is sufficiently reliable for this report.

## **Review of Internal Controls**

We reviewed the *University of Colorado at Boulder Departmental Financial Management Guide, Chapter 14-Sponsored Projects Accounting* policies regarding responsibilities for managing a sponsored project. Specifically, the University's policy requires a PI, with assistance from administrative staff, establish a means to ensure that:

1. No more than the amount authorized by the sponsor for the project period is spent;
2. Sponsor limitations on the amount of money that may be spent in any single budget category is adhered to;
3. Costs are incurred only for goods or services that will be received and used during the project period;
4. Only those expenditures that are reasonable and necessary to accomplish the project objectives, and that are also consistent with the terms and conditions of the sponsor, are authorized; and,
5. Fiscal stewardship is maintained over the sponsored project ensuring the reasonable and prudent use of sponsor funds.

The control weaknesses that we identified are discussed in this report. Our recommendations, if implemented, will correct the identified control weaknesses.

## Prior Coverage

During the last 5 years, the NASA OIG and the GAO have issued ten reports of particular relevance to the subject of this report.<sup>15</sup> Unrestricted reports can be accessed at <http://oig.nasa.gov/audits/reports/FY14/index> (NASA OIG) and <http://www.gao.gov> (GAO).

### NASA Office of Inspector General

“Audit of Grant Awarded to North Carolina State University” (IG-14-027, July 23, 2014)

“Audit of NASA’s Cooperative Agreement Awarded to Rockwell Collins” (IG-14-025, July 14, 2014)

“NASA’s Challenges to Meeting Cost, Schedule, and Performance Goals” (IG-12-021, September 27, 2012)

“Audit of NASA Grant Awarded to HudsonAlpha Institute for Biotechnology” (IG-12-019, August 3, 2012)

“Audit of NASA Grants Awarded to the Philadelphia College Opportunity Resources for Education” (IG-12-018, July 26, 2012)

“Audit of NASA Grants Awarded to the Alabama Space Science Exhibit Commission’s U.S. Space and Rocket Center” (IG-12-016, June 22, 2012)

“NASA’s Use of Research Announcement Awards for Aeronautics Research” (IG-12-011, April 30, 2012)

“NASA’s Grant Administration and Management” (IG-11-026, September 12, 2011)

“Audit of NASA’s Recovery Act Procurement Actions at Johnson Space Center, Goddard Space Flight Center, Langley Research Center, and Ames Research Center” (IG-10-017, July 27, 2010)

### Government Accountability Office

“Implementation of Grants Policies Needs Better Oversight” (GAO-14-635, July 21, 2014)

“Improving the Timeliness of Grant Closeouts by Federal Agencies and Other Grants Management Challenges” (GAO-12-704T, July 25, 2012)

---

<sup>15</sup> Three of the GAO reports listed are testimonies.

“Federal Grants: Improvements Needed in Oversight and Accountability Processes”  
(GAO-11-773T, June 23, 2011)

“Agencies Face Challenges in Tracking Contracts, Grants, Cooperative Agreements, and Associated Personnel” (GAO-10-509T, March 23, 2010)

“Department of Education Could Improve Its Processes with Greater Focus on Assessing Risks, Acquiring Financial Skills, and Sharing Information” (GAO-10-57, November 19, 2009)

---

---

## PRODUCTS AND SERVICES PROVIDED BY THE COOPERATIVE AGREEMENT

---

Through February 2014, Johnson and BioServe modified the basic agreement 13 times.<sup>16</sup> In addition to performing research on the *Jatropha* plant and developing the bio lab and multi-well projects, BioServe provided a variety of payload integration and operations services to enable research on the ISS National Lab.

**Modification 3.** *Commercial Generic Bioprocessing Apparatus Science Insert-05* – A science experiment involving K-12 classrooms via the internet. BioServe designed hardware that housed spiders, fruit flies, and seed germination experiments, as well as provided integration and operations for the flight on Space Transportation System (STS) -134.

**Modification 4.** *Advanced Integration and Operations in Support of Commercial Biotechnology Flight Research on STS-135* – In collaboration with five external corporations, agencies, institutions, and universities, BioServe designed and conducted a rodent (mouse) research experiment (Commercial Biomedical Testing Module-03) and worked with a PI at Arizona State University on a second experiment (Recombinant Attenuated Salmonella Vaccine), both on board STS-135. In addition, BioServe provided services of payload integration, safety, mission planning, payload verification, and flight certification, as well as payload operations.

**Modification 5.** *An Augmentation Proposal for Cooperative Agreement #NNJ10GA25A* – BioServe supported a NASA research experiment (Shear History Extensional Rheology Experiment II) by utilizing one of its Commercial Generic Bioprocessing Apparatus assets currently on board the ISS for thermal conditioning of the experiment sample sets.

**Modification 8.** *Supplement to NNJ10GA25A; Commercial Generic Bioprocessing Apparatus Science Insert-06 Support* – A science experiment involving K-12 classrooms via the internet. BioServe designed hardware that housed experiments with pavement ants, which launched on the Orbital-1 mission and was conducted onboard the ISS.

---

<sup>16</sup> Modifications 1, 2, 7, 9, and 13 were administrative modifications made to deobligate or reobligate funds, extend periods of performance, and update NASA points of contact and did not require BioServe provide products or services.

**Modification 10.** *Supplement to NNJ10GA25A: YouTube Space Lab Support* – To complete analysis of bacteria samples from the YouTube Space Lab Experiment conducted on board the ISS in summer 2012.

**Modification 11.** *Modification of BioServe Commercial Generic Bioprocessing Apparatus Fleet Hardware to Operate as Rear-Breathing Transportation Payload on ISS Cargo Resupply Services Vehicles* – BioServe modified the Commercial Generic Bioprocessing Apparatus to operate as rear-breathing transportation on ISS cargo resupply services vehicles.

---

---

## MANAGEMENT COMMENTS

---

National Aeronautics and Space Administration  
Headquarters  
Washington, DC 20546-0001



JUL 30 2014

Reply to Attn of: Human Exploration and Operations Mission Directorate

TO: Assistant Inspector General for Audits

FROM: Associate Administrator for Human Exploration and Operations

SUBJECT: Response to OIG Draft Report, "Audit of NASA's Cooperative Agreement with BioServe Space Technologies - University of Colorado at Boulder" (Assignment No. A-14-003-00)

The Human Exploration and Operations Mission Directorate (HEOMD) appreciates the opportunity to review and provide comments on the Office of Inspector General (OIG) draft report entitled, "Audit of NASA's Cooperative Agreement with BioServe Space Technologies - University of Colorado at Boulder" (Assignment No. A-14-003-00), dated July 1, 2014.

In the draft report, the OIG makes three recommendations to the Associate Administrator for Human Exploration and Operations, in coordination with the Assistant Administrator for Procurement. Specifically, the OIG recommends the following:

**Recommendation 1:** Ensure that NASA and BioServe better identify and understand the technical requirements when negotiating the cooperative agreement and that the Agency improves its process of evaluating BioServe's proposed costs so that approved project budgets will better approximate actual expenditures.

**Management's Response:** NASA concurs with the recommendation. NASA will ensure that future work has budget and schedule reserve identified at the outset which will cover fine-tuning of requirements or recovery from anomalies that may occur during the development process. Any requirements changes will be evaluated by NASA and BioServe to understand their impact on cost and schedule before proceeding. A process change to introduce budget and schedule reserve is expected to be completed by August 1, 2014. However, full implementation is contingent upon receipt of a follow-on proposal from the recipient, the timing of which is currently unknown/to be determined.

**Recommendation 2:** Require that, for all future awards, BioServe separately account for and report expenditures incurred for each project.



**Management's Response:** NASA concurs with the recommendation. BioServe and the University of Colorado Boulder's Office of Contracts and Grants have already agreed to institute separate accounting on a project basis. Consequently, we request closure of this recommendation upon issuance of the final report or shortly thereafter.

**Recommendation 3:** Monitor actual performance against the cost and schedule milestones that NASA and BioServe negotiated for the remaining deliverables on the bio lab and multi-well projects to minimize the risk of further cost and schedule overruns.

**Management's Response:** NASA concurs with the recommendation. NASA intends to continue monitoring the performance of BioServe during regular Technical, Cost, and Schedule Reviews. In addition, having BioServe track costs associated with each project separately will enhance the ability to provide oversight. This activity is ongoing through the expiration of the current agreement on March 31, 2015.

We have reviewed the draft report for information that we believe should not be publicly released and have provided our concerns regarding public release of that information to the OIG.

Again, thank you for the opportunity to review and comment on the subject draft report. If you have further questions or require additional information on the NASA response to the draft report, please contact Michelle Bascoe at 202-358-1574.

  
William H. Gerstenmaier

cc:  
Office of Procurement/Mr. McNally

---

---

## **REPORT DISTRIBUTION**

---

### **National Aeronautics and Space Administration**

Administrator  
Associate Administrator  
Chief of Staff  
Associate Administrator for Human Exploration and Operations  
Assistant Administrator for Procurement

### **Non-NASA Organizations and Individuals**

Office of Management and Budget  
Deputy Associate Director, Energy and Science Division  
Branch Chief, Science and Space Programs Branch  
Government Accountability Office  
Director, Office of Acquisition and Sourcing Management  
University of Colorado at Boulder

### **Congressional Committees and Subcommittees, Chairman and Ranking Member**

Senate Committee on Appropriations  
Subcommittee on Commerce, Justice, Science, and Related Agencies  
Senate Committee on Commerce, Science, and Transportation  
Subcommittee on Science and Space  
Senate Committee on Homeland Security and Governmental Affairs  
House Committee on Appropriations  
Subcommittee on Commerce, Justice, Science, and Related Agencies  
House Committee on Oversight and Government Reform  
Subcommittee on Government Operations  
House Committee on Science, Space, and Technology  
Subcommittee on Oversight  
Subcommittee on Space

Major Contributors to the Report:

Ridge Bowman, Director, Space Operations Directorate

Kenneth Sidney, Project Manager

Ellis Lee, Lead Auditor

Gene Bauer, Auditor

Cedric Campbell, Associate Counsel to the Inspector General – Central Region

Sarah McGrath, Editor

AUGUST 4, 2014

REPORT No. IG-14-028



OFFICE OF AUDITS

OFFICE OF INSPECTOR GENERAL

#### ADDITIONAL COPIES

Visit <http://oig.nasa.gov/audits/reports/FY14/> to obtain additional copies of this report, or contact the Assistant Inspector General for Audits at 202-358-1232.

#### COMMENTS ON THIS REPORT

In order to help us improve the quality of our products, if you wish to comment on the quality or usefulness of this report, please send your comments to Mr. Laurence Hawkins, Audit Operations and Quality Assurance Director, at [Laurence.B.Hawkins@nasa.gov](mailto:Laurence.B.Hawkins@nasa.gov) or call 202-358-1543.

#### SUGGESTIONS FOR FUTURE AUDITS

To suggest ideas for or to request future audits, contact the Assistant Inspector General for Audits. Ideas and requests can also be mailed to:

Assistant Inspector General for Audits  
NASA Headquarters  
Washington, DC 20546-0001

#### NASA HOTLINE

To report fraud, waste, abuse, or mismanagement, contact the NASA OIG Hotline at 800-424-9183 or 800-535-8134 (TDD). You may also write to the NASA Inspector General, P.O. Box 23089, L'Enfant Plaza Station, Washington, DC 20026, or use <http://oig.nasa.gov/hotline.html#form>. The identity of each writer and caller can be kept confidential, upon request, to the extent permitted by law.