

JUNE 18, 2010

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AUDIT REPORT

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OFFICE OF AUDITS

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# REVIEW OF NASA'S MICROGRAVITY FLIGHT SERVICES

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OFFICE OF INSPECTOR GENERAL

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National Aeronautics and  
Space Administration

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

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CO	Contracting Officer
COTR	Contracting Officer's Technical Representative
FAR	Federal Acquisition Regulation
FCOD	Flight Crew Operations Directorate
NPR	NASA Procedural Requirements
OIG	Office of Inspector General
SOMD	Space Operations Mission Directorate

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## OVERVIEW

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# REVIEW OF NASA'S MICROGRAVITY FLIGHT SERVICES

## The Issue

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NASA began microgravity flight operations at Johnson Space Center in 1973 using Government-owned, Government-operated aircraft. Microgravity flight operations provide a short duration reduced gravity environment for NASA research, engineering, astronaut training, and education. NASA first used a modified Boeing KC-135A and later a McDonnell Douglas DC-9B (C-9) as the Agency's microgravity flight services aircraft. In 1995, the House Committee on Science reported<sup>1</sup> that Congress found no national security or mission-critical justification for NASA to maintain its own fleet of aircraft to provide a short duration microgravity environment via parabolic flight.<sup>2</sup> Accordingly, Congress directed that NASA privatize microgravity parabolic flight operations. However, at that time NASA could not find a viable domestic source for the services. In January 2008, NASA awarded the Zero Gravity Corporation (Zero G) a 1-year, \$4.8 million indefinite-delivery, indefinite-quantity contract,<sup>3</sup> for microgravity services after a competitive procurement.<sup>4</sup>

We initiated this audit to determine whether Zero G was providing adequate microgravity flight services and whether NASA was paying for microgravity services in accordance with the contract terms. In addition, we reviewed NASA's efforts to disposition its C-9 aircraft. Details of the audit's scope and methodology are in Appendix A.

## Results

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Zero G has provided inconsistent quality levels of microgravity flight services since it began providing NASA with reduced gravity flights in August 2008. We concluded that NASA should revise the contract's performance-based payment structure to motivate

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<sup>1</sup> House Report 104-233, which commented on the National Aeronautics and Space Administration Authorization Act, Fiscal Year 1996. Available online at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=104\\_cong\\_reports&docid=f:hr233.104.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=104_cong_reports&docid=f:hr233.104.pdf) (accessed April 21, 2010).

<sup>2</sup> Parabolic flights are achieved when an aircraft flies at altitudes between 24,000 and 34,000 feet conducting aerobatic maneuvers that resemble a series of gently rolling hills creating about 20 to 30 seconds of weightlessness.

<sup>3</sup> The contract consisted of a base year, 2008, and four option years. Maximum value of the contract is approximately \$26 million if NASA exercises all options through 2012.

<sup>4</sup> In November 2006, the Office of Inspector General (OIG) received an anonymous complaint alleging that the procurement for microgravity services may be improper, would waste Government funds, and would raise potential safety concerns. We did not find evidence to substantiate the complaint.

Zero G to provide more consistent, high-quality microgravity flights. We also found that NASA had not implemented a risk management plan that adequately identified and mitigated risks associated with the possibility of Zero G not providing microgravity flight services in the future. In addition, we found that NASA's payments to Zero G of approximately \$2 million over a two-year period were in accordance with the contract terms, with the exception of a \$23,000 overpayment that was due to math errors.

**The Quality of Zero G's Microgravity Flight Service Was Inconsistent.** We determined that Zero G's performance in providing microgravity flight services over the life of the contract has been inconsistent. During some of the period of performance, Zero G's performance was satisfactory. However, their performance during other periods was not. Specifically, the percentage of parabolas meeting contract specifications during the 9 flight weeks from August 2008 through August 2009 that Zero G provided microgravity flight services varied from a low of approximately 38 percent (April 2009) to a high of 84 percent (August 2009). NASA researchers stated that they have greater opportunity to successfully conduct their experiments when Zero G flies a high rate of parabolas that meet contract specifications. In that regard, Zero G improved its rate of successful parabolas<sup>5</sup> flown since contract inception. For example, during the first flight week in August 2008, Zero G flew just 54 percent successful parabolas. Following some aircraft modifications and parabolic flight training for its pilots, Zero G flew 84 percent successful parabolas during the flight week in August 2009 and 83 percent of the researchers we surveyed rated Zero G's flight services for that week as good or excellent.

We concluded that the contract NASA entered into with Zero G does not motivate consistent, high-quality performance on the part of the contractor. Specifically, the indefinite-delivery, indefinite-quantity contract provides for performance-based payments that allow Zero G to receive 100 percent of the negotiated hourly rate if the contractor flies only 60 percent successful parabolas, and 80 percent to 90 percent of the hourly rate when Zero G flies just 30 percent to 59 percent successful parabolas. This payment structure was originally designed to encourage bidding on the contract and motivate contractors to meet performance levels. However, Zero G was the sole bidder on the contract, and the structure of the agreement resulted in Zero G earning approximately 94 percent of the value of the issued task orders even though Zero G exceeded an 80 percent successful parabola rate during only 2 of its 9 flight weeks from August 2008 through August 2009. Therefore, to provide incentive for Zero G to consistently deliver a higher parabola success rate, we recommend that NASA revise the contract's performance-based payment structure so that payments more accurately reflect the contractor's performance.

**NASA Has No Risk Management Plan for Loss of Zero G Services.** The Flight Crew Operations Directorate (FCOD) at Johnson had not developed a written, approved plan to mitigate the risk if, for some reason, Zero G stopped providing microgravity flight

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<sup>5</sup> Reduced gravity aboard an aircraft is achieved through aerobatic maneuvers known as parabolas flown by specially trained pilots. Successful parabolas are parabolas that meet both the microgravity level and length of time established by the contract statement of work.

services to NASA. NASA Procedural Requirements (NPR) 8000.4A, “Agency Risk Management Procedural Requirements,” December 16, 2008, requires that the manager of each NASA organizational unit designate a risk manager and develop a risk management plan to address safety, technical, cost, and schedule risks. The Johnson FCOB stated that a risk management plan was not developed for the possible loss of microgravity flight capability because the Space Operations Mission Directorate (SOMD) intends to use the C-9 aircraft, which is in flyable storage,<sup>6</sup> if Zero G withdraws from the contract or cannot perform. However, NASA management had not adequately considered the cost of maintaining the C-9 in an operational status nor analyzed the potential that using the C-9 may not meet its needs for microgravity flight services and had not developed a formal plan to mitigate that risk.

NASA’s Reduced Gravity Program, which provides the simulated weightlessness of a zero gravity space flight environment for the development and verification of space hardware and experiments, crew training, and basic research could be adversely affected by schedule delays and cost increases if Zero G is unable or unwilling to provide flight services. Although Zero G stated that it is committed to fulfilling its NASA contract, which has options through 2012, Zero G is currently the sole domestic commercial provider of microgravity flight services. Therefore, NASA faces an unmitigated risk of interruption in microgravity flight services if Zero G is unable or unwilling to provide flight services in the future.

**NASA Overpaid Zero G Due to a Lack of Internal Controls.** In examining the approximately \$2 million in payments NASA made to Zero G in accordance with the terms of the contract, we determined that NASA overpaid Zero G by approximately \$23,000. The contracting officer (CO) transposed numbers for the hourly flight rate that resulted in overpayments to Zero G, which went undetected by NASA and Zero G. The overpayment went undetected because the Glenn Research Center’s Procurement Division, which managed the contract, had not implemented adequate internal controls to validate that the CO’s calculations were accurate and the payments were consistent with the contract terms. After we brought the calculation errors to the CO’s attention, steps were taken to recover the overpayment by coordinating with the contractor and reducing the next disbursement to Zero G by the amount of the overpayment. We concluded that NASA needs to improve its internal controls to validate calculations and payments in its contract with Zero G.

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<sup>6</sup> The intent was to reduce costs to the minimal subsistence level while keeping the aircraft available should it be needed. During flyable storage, NASA generally flies the C-9 for one 2-hour flight every 6 weeks to maintain one flight crew at minimal currency levels. No operational flying (other than to maintain currency levels) occurs without specific approval of NASA Headquarters.

## Management Action

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We recommended that the Johnson Director of Procurement negotiate a revised performance-based payment structure to provide incentives for Zero G to deliver more consistent, high-quality microgravity flight services. We also recommended that the Associate Administrator for SOMD direct the Johnson FCOD to develop a risk management plan for meeting NASA's microgravity flight needs if Zero G is unwilling or unable to do so. In addition, we recommended that the Chief of Glenn's Procurement Division implement additional controls to detect and prevent errors when calculating payments to contractors.

In response to our May 19, 2010, draft of this report, the Associate Administrator for Space Operations generally concurred with our recommendations and stated that NASA will redefine the payment structure in the follow-on microgravity contract, will formally document a risk management plan in Johnson's Integrated Risk Management Application, and will implement controls to avoid errors in payments to contractors (see NASA's comments in Appendix D).

We consider the Associate Administrator's proposed actions to be responsive to our recommendations. Therefore, the recommendations are resolved and will be closed upon verification that management has completed the corrective actions.

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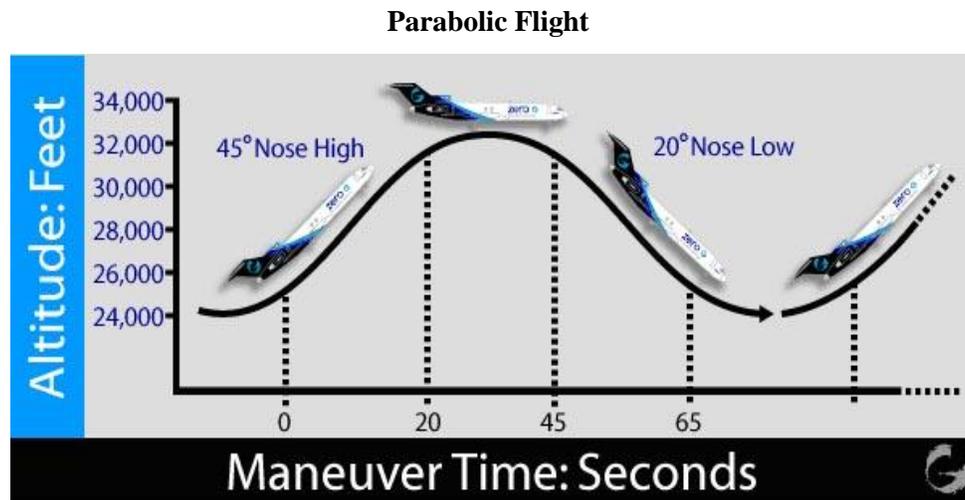
## INTRODUCTION

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### Background

**Microgravity Flight.** Microgravity flights provide a short duration reduced gravity environment for NASA research, engineering, astronaut training, and education. Reduced gravity aboard an aircraft is achieved through aerobatic maneuvers known as parabolas flown by specially trained pilots (as shown in the following figure).

Before starting a parabola, the pilot flies level to the horizon at an altitude of around 24,000 feet. The pilot begins to pull up, gradually increasing the angle of the aircraft to about 45 degrees above the horizon and reaching an altitude of approximately 34,000 feet. During ascent, passengers feel the pull of 1.8 times the gravitational force of Earth. Next, the plane is “pushed over” to create the microgravity segment of the parabola.<sup>7</sup> For the next 20 to 30 seconds, passengers in the plane experience varying degrees of weightlessness as the aircraft drops from approximately 34,000 to 24,000 feet. When the plane pulls out of the dive, it may resume level flight for a period of time before beginning the next parabola.



Source: [http://www.gozerog.com/index.cfm?fuseaction=Experience.How\\_it\\_Works](http://www.gozerog.com/index.cfm?fuseaction=Experience.How_it_Works)  
(accessed December 28, 2009; as of April 21, 2010, the link is to a video).

In addition to simulating zero gravity, parabolic maneuvers also can simulate lunar gravity (one-sixth the gravity of Earth) or Martian gravity (one-third the gravity of Earth). These varying gravity levels are created by flying a larger arc at the top of the parabola.

<sup>7</sup> As the plane goes over the top of the arc, the centrifugal force cancels out the gravitational force pulling downward. At this point, passengers experience microgravity because only negligible gravitational forces are present. The sense of weightlessness lasts for about 30 seconds.

A parabolic flight maneuver requires approximately 10 miles of airspace to perform. During a typical flight, the pilot flies 3 to 5 sets of 12 to 15 parabolic maneuvers with short periods of level flight between each set.

**History of NASA’s Microgravity Flight Services.** The Flight Crew Operations Directorate (FCOD) at Johnson Space Center operates NASA’s Reduced Gravity Program under the direction of the Space Operations Mission Directorate (SOMD). The Reduced Gravity Program provides the simulated weightlessness of a zero gravity space flight environment for test and training purposes – specifically, for the development and verification of space hardware and experiments, crew training, and basic research. Beginning about 1958, microgravity flight services were provided to NASA by the U.S. Air Force. In 1973, NASA personnel at Johnson began providing microgravity services using a modified Boeing KC-135A aircraft. In 2005, NASA began using a McDonnell Douglas DC-9B (C-9) aircraft obtained from the U.S. Navy for microgravity flights. From that point until 2008, the C-9 was the primary source for NASA’s microgravity flights.

In an August 1995 U.S. House of Representatives Report,<sup>8</sup> the Committee on Science stated that Congress found no national security or mission-critical justification for NASA to maintain a fleet of aircraft to provide microgravity flight services. The House Report states that NASA “shall privatize all parabolic flight aircraft operations . . .” However, NASA could not find a viable domestic source for microgravity flights at that time, and it was not until the fall of 2004 that the Zero Gravity Corporation (Zero G) commenced commercial microgravity flight operations. Subsequently, in September 2005 NASA’s Office of Program Analysis and Evaluation conducted a trade study to compare microgravity flight services costs and capabilities of NASA’s C-9 with Zero G’s Boeing 727. Although the study showed that there would be an approximately 90 percent increase in direct cost per flight hour, it concluded that in light of decreasing demand for microgravity flight services, there would be little difference in the overall full cost to NASA. In a November 2005 letter to NASA’s Associate Administrator, the Associate Administrator for Program Analysis and Evaluation stated that “[Johnson Space Center] should begin the procurement process to acquire all other reduced gravity aircraft services from Zero G.”

In July 2006, Johnson initiated market research to determine commercial microgravity sources through a Request for Information on the Federal Business Opportunities portal.<sup>9</sup> Although four companies, including Zero G, expressed interest in providing NASA with microgravity flight services in response to the Request for Information, only Zero G could provide an aircraft. The other three companies were interested in a contract using a Government-furnished aircraft. Federal Acquisition Regulation (FAR) Part 45.102, “Government Property, Policy,” states that “[c]ontractors are ordinarily required to

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<sup>8</sup> House Report 104-233, which provided comments on the National Aeronautics and Space Administration Authorization Act, Fiscal Year 1996. Available online at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=104\\_cong\\_reports&docid=f:hr233.104.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=104_cong_reports&docid=f:hr233.104.pdf) (accessed April 21, 2010).

<sup>9</sup> <https://www.fbo.gov/> (accessed April 21, 2010).

furnish all property necessary to perform Government contracts.” Further, NASA FAR Supplement, Part 1845.102-70, “Government Property, NASA policy,” states that “Government property shall not be provided to contractors unless all other alternatives are not feasible.” Accordingly, NASA’s procurement team required interested companies to provide their own aircraft as part of their proposal.

On January 2, 2008, NASA awarded an indefinite-delivery, indefinite-quantity contract with 4 option years to Zero G for microgravity flight services through 2012. The maximum contract value is approximately \$26 million if all options are exercised. Glenn Research Center’s Procurement Division managed the contract with Zero G from its inception through June 2009, when responsibility transferred to Johnson’s Office of Procurement. The contract provides that NASA will schedule a minimum of 1 but not more than 20 flight weeks<sup>10</sup> (approximately 8.4 to 168 hours) each contract year and sets flight-hour rates ranging from \$27,800 to \$31,289 for flights from Johnson. From contract inception in January 2008 through March 2010, Zero G flew only about 70 flight hours during 9 flight weeks. According to NASA officials, the low number of microgravity flight hours was due in part to decreasing budgets, concern for the quality of Zero G’s flight services, and the full cost of the Zero G flight service being borne by the users of the services, such as NASA researchers and the Office of Education.

**Disposition of NASA’s C-9.** During fiscal years 2006 and 2007, the last years the C-9 was fully operational before NASA began removing it from active microgravity flight service, the C-9 flew an annual average of 168 microgravity flight hours. In 2008, the C-9 flight rate decreased in order to redirect some flights to the Zero G contract. In fiscal years 2008 and 2009, the C-9 flew approximately 107 and 39 microgravity flight hours, respectively. (See Table 1 for C-9 microgravity flights by year.)

On November 19, 2008, NASA’s Strategic Management Council directed SOMD and Johnson to place the C-9 aircraft in flyable storage by January 2009 for transition or disposal upon completion of the Space Shuttle Program. Except for completing a series of previously approved physiological experiments, NASA stopped using the C-9 aircraft for microgravity flights in January 2009 and placed the aircraft in flyable storage at Ellington Field in Houston, Texas. Johnson officials said that flyable storage reduces costs to a minimum while keeping the aircraft available for microgravity flight should it be needed. Flyable storage costs for January through December 2009 totaled approximately \$854,000. This compares to total operational costs of approximately \$2.8 million in fiscal year 2007, the last year the C-9 was fully operational. In February 2009, the Acting NASA Administrator issued a Program Decision Memorandum that directed SOMD to retain the C-9 in flyable storage through fiscal year 2011.

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<sup>10</sup> A flight week begins on Monday with a test readiness review. Flights are conducted Tuesday through Friday. Each flight includes reduced gravity parabolic trajectories. Aircraft unloading is conducted on Friday after the flight is completed. Normal hours for flight week activities are 7 a.m. to 6 p.m. Flight weeks have only been conducted out of Ellington Field in Houston, Texas, although they can also be conducted out of Glenn Research Center in Cleveland, Ohio.

<b>Table 1. C-9 Flights by Fiscal Year</b>			
<b>Fiscal Year</b>	<b>Microgravity Flight Hours</b>	<b>Flights</b>	<b>Notes</b>
2005	6.6	4	C-9 was operational for only 1 month in 2005
2006	184.9	97	
2007	151.1	72	
2008	106.6	56	C-9 flights reduced because of Zero G contract
2009	39.0	16	All C-9 flights after January 1, 2009, required NASA Headquarters' approval as exceptions. In addition, the Johnson Director can approve C-9 flights to support hurricane evacuation.

NASA generally flies the C-9 for one 2-hour flight every 6 weeks to maintain aircrew at minimum currency levels.<sup>11</sup> No other use of the C-9 aircraft occurs without specific approval of NASA Headquarters.<sup>12</sup> Examples of other flights since January 2009 included scouting a safe route for the Space Shuttle when it needed to be flown back to Kennedy Space Center in Florida from Edwards Air Force Base in California in June 2009 and again in September 2009.

Personnel in NASA's Aircraft Management Division stated that the final disposition of the C-9 will depend on Zero G demonstrating sustained success in meeting NASA's microgravity mission requirements. They also said that the Office of Infrastructure will make the decision concerning the C-9's final disposition after reviewing aircraft requirements in accordance with NPR 7900.3B, "Aircraft Operations Management," June 14, 2007.

**Office of Inspector General (OIG) Reviews.** In November 2006, the OIG received an anonymous complaint alleging that the procurement for microgravity services may be improper, would result in a waste of Government funds, and raised potential safety concerns. An initial OIG review did not substantiate the complaint, but we conducted a follow-up review in June 2008 to determine (1) the status of the contract, (2) whether the task orders issued to Zero G exceeded NASA's mission requirements, and (3) whether any NASA civil service positions were eliminated because of the contract. We determined that NASA had issued two task orders (as of June 2008) valued at approximately \$467,000 to Zero G for approximately 17 microgravity flight hours. With just two task orders issued, we could not determine whether the contract had resulted in the acquisition of microgravity flight capability that exceeded the Agency's mission

<sup>11</sup> Each aircraft crew position for each aircraft type has a minimum set of requirements, such as flight hours and landing approaches, which must be accomplished periodically so that the aircrew can fly the aircraft's mission without an instructor present.

<sup>12</sup> The Director, Johnson Space Center, can authorize the use of the C-9 for hurricane evacuation.

requirements. Although we determined that the award of the Zero G contract did not eliminate any civil service positions, Johnson estimated that any Agency decision to discontinue the Reduced Gravity Program would result in reassigning the work of approximately two full-time equivalent employees.

### **Objectives**

The overall objective of this audit was to determine whether Zero G provided adequate microgravity flight services to NASA and was paid in accordance with the contract terms. We also evaluated NASA's efforts to disposition the C-9 aircraft it formerly used to conduct its own microgravity flights. See Appendix A for details of the audit's scope and methodology, our review of internal controls, and prior coverage.

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## THE QUALITY OF ZERO G'S MICROGRAVITY FLIGHT SERVICE WAS INCONSISTENT

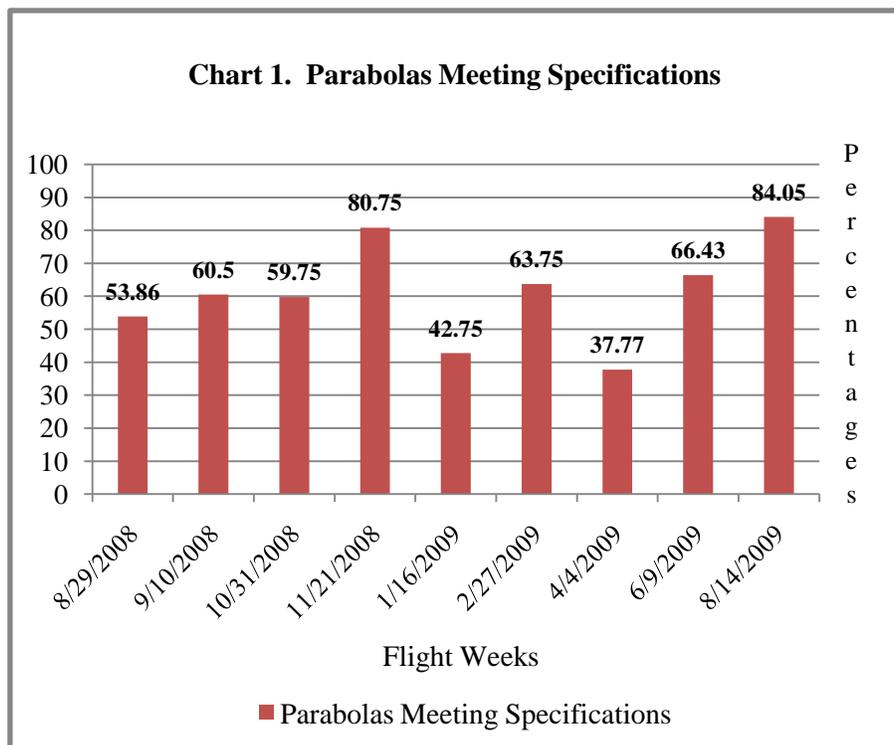
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We found that Zero G provided inconsistent levels of microgravity flight services to NASA. Specifically, the percentage of parabolas meeting contract specifications during the 9 flight weeks from August 2008 through August 2009 that Zero G provided microgravity flight services ranged from a low of approximately 38 percent (April 2009) to a high of 84 percent (August 2009), with a mean of 61 percent. NASA researchers stated that they have a greater opportunity to conduct experiments when parabolas consistently meet contract specifications.

The lead NASA technician for the Reduced Gravity Program stated that the quality of Zero G's parabolas had improved over time after modifications to Zero G's Boeing 727 aircraft and completion of parabolic maneuver training by Zero G's pilots. However, we believe that the performance-based payment structure in the indefinite-delivery, indefinite-quantity contract with Zero G does not provide sufficient financial incentives for Zero G to provide consistent, high-quality reduced gravity flights. For example, NASA pays 100 percent of the contract's hourly rate even if only 60 percent of Zero G's parabolas meet contract specifications on a given flight. When less than 60 percent of the parabolas meet the statement of work specifications, NASA pays Zero G a reduced percentage of the hourly rate. NASA established the performance-based payment structure to encourage the contractor to meet required performance levels yet keep penalties small enough to attract bidding on the contract. However, the payment structure has resulted in Zero G earning approximately 94 percent of the value of the issued task orders even though Zero G exceeded an 80 percent successful parabola rate in only 2 of its 9 flight weeks from August 2008 through August 2009. Moreover, only 5 of the 9 flight weeks (56 percent) from August 2008 through August 2009 averaged more than a 60 percent success rate.

### **Inconsistent Microgravity Flight Services**

The lead NASA technician for the Reduced Gravity Program stated that the quality of Zero G's parabolas had improved over time after some modifications to Zero G's 727 aircraft and completion of parabolic maneuver training by Zero G's pilots. Although Zero G's parabola success rate rose from 54 percent for the August 2008 flight week to 84 percent for the August 2009 flight week, Zero G's performance was inconsistent during the first 12-month period, exceeding a 60 percent weekly success rate only five times and an 80 percent weekly parabola success rate only twice over the 9 flight weeks from August 2008 through August 2009. Chart 1 shows the weekly percentage of parabolas Zero G flew that met contract specifications.



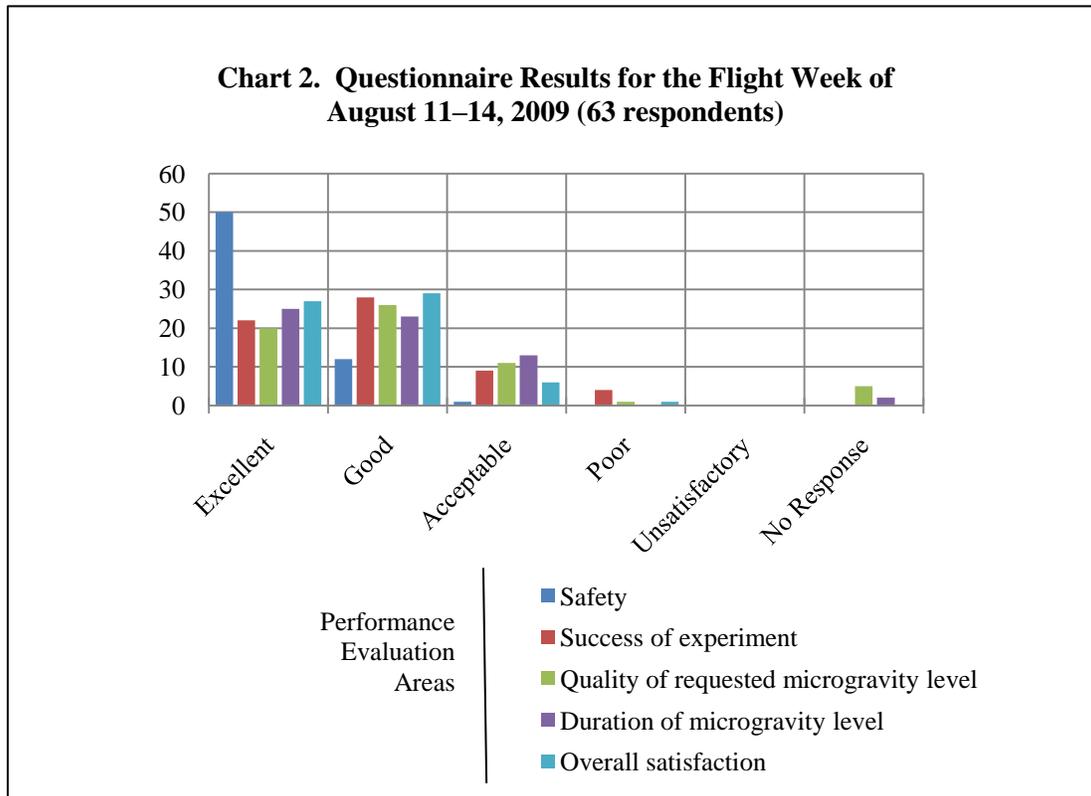
The Johnson FCOD and program managers stated that the historic parabola success rate with the C-9 had been over 90 percent. NASA program managers told us that Zero G's performance has been an issue of concern for researchers, who now had to fund the full cost of the flight services. The program managers said they have a greater likelihood of successfully completing experiments when parabolas consistently meet contract specifications. A Zero G program manager conceded that the company has experienced performance challenges, but stated that the company had dedicated its own resources to improve the quality of microgravity flight services by installing better instrumentation on the aircraft and providing pilot training to increase proficiency.

### **Zero G Provided Satisfactory Flight Services during the August 2009 Flight Week**

We developed a questionnaire for NASA researchers conducting reduced gravity experiments to assess user satisfaction with Zero G's microgravity flight services (see Appendix B). The questionnaire asked the researchers to rate safety, success of their experiment, quality and duration of the microgravity level, and overall satisfaction.

We distributed the questionnaire to the 88 researchers who participated in Zero G's August 11–14, 2009, flight week. The researchers conducted a variety of experiments that included microgravity fluid dynamics, Martian and lunar dust mitigation, modeling of cardiovascular dynamics, and measures to counter motion sickness. We received

63 completed questionnaires (a 72 percent return rate). Overall, Zero G's flight services ratings were mostly good or excellent, as shown in Chart 2.



## Microgravity Flight Specifications and Payment Structure

The Zero G contract establishes microgravity flight requirements and performance-based payments based on the number of acceptable flight maneuvers performed by Zero G.<sup>13</sup> NASA evaluated each flight flown from August 2008 through August 2009 during the 9 flight weeks<sup>14</sup> purchased from Zero G under the contract.

The original contracting officer's technical representative (COTR) at Glenn stated that prior to release of the request for proposal, the acquisition team – which included subject matter experts with experience in microgravity flight services – developed the performance standards. These standards included safety, for which failure to meet NASA

<sup>13</sup> Payment rates established in the contract for years 2008 through 2012 range from \$27,800 to \$31,289 per flight hour for flights out of Johnson. Payments can be adjusted downward based on parabola success rates.

<sup>14</sup> NASA issued 12 task orders for 12 flight weeks, but subsequently terminated 3 flight weeks due to lack of funding.

requirements would result in zero payment; contractor-caused delays, which would result in downward price adjustments; and parabola quality. As of March 2010, there have been no payment adjustments due to safety or contractor-caused delays.

The COTR stated that the objectives of the parabola quality standard were to encourage the contractor to have an aircraft guidance system capable of meeting the gravity level requirements and to motivate the contractor to use its best pilots over the life of the contract to achieve the highest percentage of required parabolas. The team based the gravity performance levels on their experience in providing microgravity services to the research community and established levels that NASA aircraft could routinely achieve, but added some buffer for human factors and weather.

Table 2 shows the flight specifications in the statement of work for microgravity or partial gravity levels and duration.

<b>Table 2. Flight Specifications</b>	
<b>Microgravity/Partial Gravity Requirements</b>	<b>Time Requirements (continuous seconds)</b>
0.00 g +/- 0.02 g	10
0.00 g +/- 0.05 g	17
0.10 g +/- 0.05 g	20
0.16 g +/- 0.05 g	20
0.20 g +/- 0.05 g	20
0.30 g +/- 0.05 g	20
0.38 g +/- 0.05 g	20
0.40 g +/- 0.05 g	20
0.50 g +/- 0.05 g	20

Although NASA payments to Zero G comply with contract terms, we do not believe that those terms motivated the contractor to consistently fly a high rate of successful parabolas. Specifically, the COTR evaluates the flights using an accelerometer mounted on board the Zero G aircraft. The accelerometer measures and records the duration and level of reduced gravity attained by Zero G during each flight.<sup>15</sup> After each reduced gravity flight, NASA determines the parabola success rate, which is the percentage of parabolic trajectories flown that met the contract specifications (statement of work) for microgravity/partial gravity requirements and time requirements (continuous seconds). In accordance with the contract’s performance-based payment structure, NASA pays Zero G 100 percent of the hourly rate when a flight’s parabola success rate meets contract specifications 60 percent of the time or more. When the success rate is less than

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<sup>15</sup> The COTR used an accelerometer on all but two flights to determine the amount earned by Zero G. Zero G flew one demonstration flight, and NASA terminated one flight due to weather conditions. In accordance with contract terms, the COTR did not evaluate those two flights, and the contractor received the full hourly rate established in the contract.

60 percent, NASA pays the contractor a reduced rate for the flight hours during that flight week, as shown in Table 3.

<b>Percentage of Reduced Gravity Maneuvers that Meet the Statement of Work</b>	<b>Payment Rate</b>
60% or more	100%
46% to 59%	90%
30% to 45%	80%
16% to 29%	70%
0 to 15%	60%

According to the COTR at Glenn, NASA's goal in establishing these performance-based payment rates was to make the penalties big enough to encourage the contractor to meet established performance levels, yet small enough that the contractor would bid on the contract and keep the price reasonable. Although there have been no payment adjustments based on safety or contractor-caused delays, payment for almost 80 percent of the task orders issued from August 2008 through August 2009 to Zero G have been decreased due to parabola quality.<sup>16</sup> Nevertheless, overall Zero G earned about 94 percent of the value of issued task orders (\$1,852,470 of \$1,980,250<sup>17</sup>).

## **Recommendation, Management's Response, and Evaluation of Management's Response**

**Recommendation 1.** The Johnson Director of Procurement should negotiate a revised performance-based payment structure to provide greater incentives for the contractor to deliver consistent, high-quality microgravity flight service.

**Management's Response.** The Associate Administrator for Space Operations concurred with the intent of the recommendation. He stated that NASA intends to redefine the payment structure during the development of the follow-on microgravity contract procurement strategy to ensure customers pay only for consistent, high-quality parabolas. However, the Associate Administrator's response stated that restructuring the current contract for option years 2011 and 2012 is not feasible for a variety of reasons described in his response. Although NASA did not provide an estimated date to redefine the

<sup>16</sup> The CO issues a task order for each flight week that typically contains four flight days. The CO decrements each task order whenever Zero G flies less than 60 percent successful parabolas during a flight day.

<sup>17</sup> These amounts do not include \$150,000 for insurance or \$64,559 fuel credits that NASA paid to Zero G.

payment structure for future microgravity flight services, we expect NASA to take this action no later than December 31, 2012, the end of the final option period for the Zero G contract.

**Evaluation of Management's Response.** The Associate Administrator's response and planned actions are responsive to the recommendation. Therefore, the recommendation is resolved. Although NASA requested that we close this recommendation upon issuance of our report, we will close the recommendation after verifying that management has taken corrective action by redefining the payment structure in the follow-on microgravity contract.

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## **NASA HAD NO RISK MANAGEMENT PLAN FOR LOSS OF ZERO G SERVICES**

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The Johnson FCOD had not developed a risk management plan to address the possibility that Zero G might be unable to perform future microgravity flight services, which would leave NASA with no commercial option to obtain microgravity flights. NASA policy requires that NASA risk managers develop a risk management plan to identify and mitigate risks to their programs. FCOD personnel stated that they had not developed a plan to address the possibility of Zero G's inability to provide microgravity flights because if that occurred they expect NASA to use its C-9 aircraft. However, NASA management had not adequately analyzed the potential for performance shortfalls, which could occur in the future with respect to meeting NASA's needs for microgravity flight services. Specifically, NASA had not developed a systematic process that identifies, analyzes, and documents risks that Zero G might not provide future microgravity flight services. As a result, NASA's Reduced Gravity Program could experience schedule delays and cost increases if Zero G, the only current commercial provider of microgravity flight services in the United States, is unable or unwilling to continue providing those services.

### **Risk Management Plan Required**

NASA Procedural Requirements (NPR) 8000.4A, "Agency Risk Management Procedural Requirements," December 16, 2008, requires that the manager of each NASA organizational unit designate a risk manager and develop a risk management plan to address safety, technical, cost, and schedule risks associated with major programs in their area of responsibility. The NPR states that risk managers should manage risks using a Continuous Risk Management process, which is defined as "a systematic and iterative process that efficiently identifies, analyzes, plans, tracks, controls, and communicates and documents risks associated with implementation of designs, plans, and processes." The NPR also states that organizational unit managers should ensure that acquisition-related risks are continuously managed and that documentation is maintained in accordance with NASA Policy Directive 1440.6H, "NASA Records Management," March 24, 2008, and NPR 1441.1D, "NASA Records Retention Schedule," February 24, 2003. Mission Directorates are responsible for management of programmatic risks within the Directorate, and program and project managers are responsible for program and project risks within their respective programs and projects.

## **Significant Risks for Microgravity Flight Services Had Not Been Adequately Identified and Mitigated**

The Johnson FCOD had not developed a formal risk management plan to identify and mitigate risks associated with the microgravity flight services. One significant risk is the potential that Zero G might be unable or unwilling to provide future microgravity flight services. We interviewed Zero G management personnel and asked whether the relatively small number of microgravity flights flown since contract award in 2008 had affected their interest in continuing to provide parabolic flight services to NASA. Zero G management stated that it was disappointed in the reduction in the number of flight weeks, but said they were committed to providing NASA with future flights. Specifically, Zero G pointed out that it had made significant investments in configuring its plane to NASA specifications and training pilots to conduct reduced gravity flights. However, because Zero G is currently the only commercial provider of microgravity flight services in the United States, we see this as a significant risk that should be assessed by FCOD and, in keeping with NASA risk management policy, specific alternatives developed.

In November 2008, NASA's Strategic Management Council directed that SOMD retain the C-9 in flyable storage through fiscal year 2011. Following the Council's direction, except for completing a series of previously approved physiological experiments, Johnson FCOD stopped using the NASA C-9 aircraft for microgravity flights in January 2009<sup>18</sup> and placed the aircraft in flyable storage at Ellington Field in Houston (see FCOD's response to the Program Decision Memorandum in Appendix C). However, SOMD personnel noted that FCOD had not incorporated the cost of maintaining the C-9 aircraft for operational use into a risk management plan addressing the risk of Zero G not providing the Agency's microgravity flight services needs. The cost of maintaining the C-9 for operational use is likely to be a significant factor and FCOD should evaluate its impact as part of a risk management plan.

## **NASA's Reduced Gravity Program Will Be Adversely Affected if Zero G Does Not Perform**

NASA's Reduced Gravity Program could experience schedule delays and cost increases if Zero G is unwilling or unable to provide future microgravity flight services. Delays in the availability of microgravity flights would negatively affect NASA research of materials and life sciences, engineering development for the next generation of space flight vehicles and the International Space Station, and for astronaut training and education. Because Zero G is currently the only commercial, domestic provider of

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<sup>18</sup> Johnson flew 51 microgravity flights (97.2 flight hours) with its C-9 in fiscal year 2008 after the contract was awarded to Zero G. According to the Johnson COTR, after contract award on January 2, 2008, Zero G was modifying its aircraft through July 2008 to better fly microgravity missions. Zero G flew its first microgravity contract flight in August 2008.

microgravity flight services, a systematic process that identifies, analyzes, and documents risk mitigation strategies, to include an analysis of cost and schedule impacts, can help reduce the potentially negative consequences associated with a disruption of microgravity flight services. Moreover, identifying another commercial microgravity provider would involve additional procurement costs and potential contract cost increases.

## **Recommendation, Management’s Response, and Evaluation of Management’s Response**

**Recommendation 2.** The Associate Administrator for SOMD should direct the Johnson FCOD to develop a formal risk management plan that identifies specific options to maintain NASA’s access to microgravity flights if Zero G ceases providing microgravity flight services. Such analyses should include the cost of identifying another commercial contractor as well as the cost of maintaining the C-9 aircraft for operational use.

**Management’s Response.** The Associate Administrator for Space Operations concurred with the intent of the recommendation and stated that FCOD will formally document a risk management plan in Johnson’s Integrated Risk Management Application and identify specific options, as well as costs, safety, and schedule considerations to maintain access to microgravity flights, in the event Zero G ceases to provide those services to NASA. The estimated completion date for this action is October 1, 2010.

**Evaluation of Management’s Response.** The Associate Administrator’s planned actions are responsive to the recommendation. Therefore, the recommendation is resolved. We will close the recommendation upon verifying that management has taken the corrective action.

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## **NASA OVERPAID ZERO G DUE TO A LACK OF INTERNAL CONTROLS**

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NASA's payments to Zero G of approximately \$2 million over a two-year period were in accordance with the contract terms, with the exception of a \$23,000 overpayment caused by math errors. We found that the Glenn contracting officer (CO) transposed numbers for the hourly flight rate in calculating payments due Zero G on three task orders and made a minor math error on one. The errors resulted in overpayments of approximately \$23,000 that were not detected by NASA or Zero G. NASA overpaid Zero G because Glenn's Procurement Division had not implemented adequate internal controls to validate that the CO's calculations were accurate and the payments were consistent with the contract terms. After we brought the payment calculation errors to the CO's attention, Glenn's Procurement Division recovered the overpayments by reducing a subsequent disbursement to Zero G by the amount of the overpayment.

### **NASA's Contract with Zero G**

We determined that NASA generally paid Zero G in accordance with contract terms; however, a lack of internal controls resulted in NASA overpaying Zero G on 4 out of 10 paid task orders. The contract requires the CO to calculate payments for each task order based on a specific hourly flight rate, the number of hours flown, and an objective performance factor for each flight. At the end of each flight week, the CO obtains the flight hours and the performance factors for each flight from the COTR. The CO calculates the amount owed to the contractor by multiplying the hourly flight rate, the number of hours flown, and the performance factor for each flight. The CO provides the contractor with the calculations, and Zero G then submits an invoice for that amount.

During 2008 and 2009, the CO issued 12 task orders and NASA paid Zero G almost \$2 million for approximately 70 flight hours, insurance, and fuel credits (see Table 4).

<b>Table 4. 2008 and 2009 Zero G Task Orders</b>		
<b>Task Order</b>	<b>Disbursed</b>	<b>Notation</b>
NNC08TA78T	\$ 307,394.89	9.2 flight hours plus \$75,000 insurance
NNC08TA79T*	278,861.40	10.4 flight hours
NNC08TA85T*	125,132.00	4.8 flight hours
NNC08TA86T*	323,729.54	11.4 flight hours
NNC08TA89T	191,337.42	8.1 flight hours
NNC08TB05T	75,000.00	insurance only; flights terminated for lack of funding
NNC08TB06T	0.00	terminated for lack of funding
NNC08TB07T	0.00	terminated for lack of funding
NNC09TA28T	188,782.40	6.9 flight hours
NNC09TA34T*	168,356.36	7.5 flight hours
NNC09TA42T	135,707.62	5.8 flight hours
NNC08TB11T	143,608.60	6.1 flight hours
<b>Total</b>	<b>\$1,937,910.23</b>	<b>70.2 flight hours and insurance</b>
*Included payment errors (see Table 5). The overpayments were recovered by an adjustment on task order NNC08TB11T.		

## CO Overpaid Zero G

As stated previously, the CO made errors that resulted in overpayments to Zero G of approximately \$23,000. The contract defines a maximum hourly flight rate of \$27,800 in 2008 for flights originating from Johnson. However, the CO transposed numbers for the hourly flight rate and used \$28,700 instead of \$27,800 in calculating payments due Zero G on three task orders and made an extremely small math error (\$0.80) on a fourth task order (see Table 5).

<b>Table 5. Overpaid Task Orders</b>		
<b>Task Order</b>	<b>Overpayment</b>	<b>Reason</b>
NNC08TA79T	\$ 8,874.00	CO used \$28,700 vice \$27,800 contract flight rate
NNC08TA85T	3,924.00	CO used \$28,700 vice \$27,800 contract flight rate
NNC08TA86T	10,260.00	CO used \$28,700 vice \$27,800 contract flight rate
NNC09TA34T	.80	CO math error
<b>Total</b>	<b>\$23,058.80</b>	

### **Internal Controls Were Inadequate to Ensure Proper Contract Payments Were Made**

Glenn's Procurement Division did not have an adequate internal control process to detect and prevent payment calculation errors. NPR 9010.3, "Financial Management Internal Control," September 30, 2008, requires that internal controls be implemented to provide reasonable assurance that all recorded transactions are valid to prevent errors from being introduced into official accounting records. However, no other Glenn employees reviewed the Glenn CO's calculations for Zero G payments. To address this control weakness, the Procurement Division could assign an independent person to validate that the CO's calculations are accurate and in accordance with the contract terms.

### **Recovery of Overpayment**

After we made the CO aware of the overpayments, the CO and Zero G signed a contract modification that described the transposition errors and documented an agreement to reduce NASA's obligation on task order NNC08TB11T by \$23,058.80. This adjustment fully recovered the overpayment.

## **Recommendation, Management's Response, and Evaluation of Management's Response**

**Recommendation 3.** The Chief of Glenn's Procurement Division should review its internal controls for payments to contractors and modify its controls and procedures to detect and prevent errors like those to Zero G when calculating payments to contractors.

**Management's Response.** The Associate Administrator for Space Operations concurred with the recommendation and stated that NASA management will instruct contracting officers with similarly complex pricing arrangements to have the contractor independently price the required services. The contracting officer will then verify the contractor's pricing against contract terms and conditions before issuing approval for payment. Although NASA's formal response did not provide a specific completion date, Glenn's Procurement Division stated in a subsequent e-mail that these actions will be completed by July 30, 2010.

**Evaluation of Management's Response.** The Associate Administrator's planned actions are responsive to our recommendation. Therefore, the recommendation is resolved. However, the recommendation will remain open until Glenn's Procurement Division issues formal policy that describes the specific contract pricing arrangements and directs contracting officers to obtain and verify the contractors' price invoices prior to approval for payment. We will close the recommendation after verifying completion of management's corrective actions.

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## APPENDIX A

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### Scope and Methodology

We performed this audit at Johnson from June 2009 through May 2010 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 the objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our objectives.

During our audit work, we reviewed NASA internal controls over the contract payments to Zero G. We reviewed the contract payment terms, performance requirements, and the amounts earned by Zero G and disbursed by NASA.

To become familiar with relevant criteria, we reviewed the Zero G contract (NNC08BA01B, January 2, 2008). We also reviewed applicable laws and NASA guidance, to include the following:

- National Aeronautics and Space Administration Authorization Act, Fiscal Year 1996, Section 212, "Privatization of Microgravity Parabolic Flight Operations."
- National Aeronautics and Space Administration Authorization Act, Fiscal Year 2005, Section 108, "Commercialization Plan."
- NPR 7900.3B, "Aircraft Operations Management," June 14, 2007, Chapter 8, "Aircraft Acquisitions and Dispositions."
- the Acting NASA Administrator's Program Decision Memorandum, February 19, 2009.
- NPR 8000.4A, "Agency Risk Management Procedural Requirements," December 16, 2008.
- NPR 9010.3, "Financial Management Internal Control," September 30, 2008.

We interviewed Johnson FCOD and Headquarters Office of Infrastructure personnel to obtain an understanding of the microgravity flight services contract, issues regarding the disposition of the C-9 aircraft, and perspectives about experiment success.

To determine whether Zero G was paid in accordance with the contract terms, we

- interviewed the NASA CO and COTRs responsible for Zero G contract oversight to obtain their evaluation of contractor performance and

- validated that the amounts billed and paid the contractor were accurate (the errors we identified are addressed in this report).

We validated that steps had been taken to recover the amount NASA overpaid the contractor. In addition, we interviewed Zero G management personnel to assess their concerns regarding the decline in NASA's microgravity flight services needs. We also inquired as to the likelihood and impact that a pilots' strike could have on Zero G's ability to provide microgravity flight services.

To determine whether Zero G was providing adequate microgravity flight services to researchers, we developed a questionnaire for researchers to evaluate satisfaction with Zero G's microgravity flight services during the August 2009 flight week (see Appendix B) and tabulated and evaluated the results of the questionnaire. Also, we met and interviewed several NASA program managers to determine whether Zero G's microgravity flights adequately met their researchers' test requirements.

To determine the C-9 aircraft's disposition status, we obtained various documentation, including the Acting NASA Administrator's Program Decision Memorandum directing SOMD and Johnson to place the C-9 aircraft in flyable storage; the Johnson FCOD response (Appendix C), implementing a plan to place the C-9 in flyable storage; and the maintenance scheduled to retain the C-9 in flight status. We also observed the C-9 in the hangar at Ellington Field and reviewed the C-9's flight history to determine whether its use was consistent with policy direction while the aircraft was in flyable storage status.

**Use of Computer-Processed Data.** We did not use computer-processed data to perform this audit.

**Review of Internal Controls.** We reviewed internal controls associated with Zero G contract administration. We found that Glenn did not have adequate controls and procedures in place to detect and prevent errors when calculating payments to the contractor for microgravity flight services. We identified errors in the CO's payment calculations, as discussed earlier in this report. Our recommendation, if implemented, will improve Glenn's controls over contract administration.

**Prior Coverage.** Neither the Government Accountability Office nor the NASA OIG has issued a report during the last 5 years that is relevant to the subject of our report. However, in 2006, the NASA OIG conducted a preliminary review in response to an anonymous complaint about NASA's planned procurement of commercial microgravity services and determined that the complainant's allegations did not have merit; we did not issue a report. We also did not issue a report on our June 2008 follow-up review of NASA's microgravity flight operations.

**QUESTIONNAIRE**

**Microgravity Flight Experiences Questionnaire**

The NASA Office of Inspector General (OIG) is conducting an audit of the Microgravity Program, the use of a commercial provider (Zero Gravity Corporation) and NASA's plans for the C-9 aircraft.

We want to obtain experimenters' opinions. Some of you have flown on the Zero Gravity Corporation 727 microgravity aircraft and some of you have experience on both the 727 and the C-9 aircraft. We have questions regarding both aircraft. Some of you may be involved in the payment process for your experiments and we have a set of questions regarding that subject. We welcome additional comments and observations regarding any of these subjects.

Please return the questionnaire by August 28, 2009 for evaluation and inclusion in our audit report. You may remain anonymous, if you wish, or provide your name and phone number in case we need additional information regarding your answers. This questionnaire is voluntary, but we encourage you to complete it. If you would like to speak to someone in the OIG about this topic, contact the lead auditor, Ms. Connia Webb at 281-483-0725.

Please return the questionnaire to [connia.p.webb@nasa.gov](mailto:connia.p.webb@nasa.gov) or via mail to Connia Webb, Office of Inspector General, Johnson Space Center, Code W-JS, Houston, TX 77058.

Name: \_\_\_\_\_ e-mail: \_\_\_\_\_  
 Phone Number: \_\_\_\_\_ Flight Date \_\_\_\_\_  
 Experiment Title: \_\_\_\_\_  
 Your Microgravity Flight Duties: \_\_\_\_\_

**727 Experiences**

How many times have you flown on the Zero Gravity Corporation 727 aircraft? \_\_\_\_\_  
 On a scale of 1 to 5, rate your experiences on the 727 aircraft. Space is provided for further comments.

	Excellent	Good	Acceptable	Poor	Unsatisfactory
Safety:	5	4	3	2	1
Overall Success of Experiment:	5	4	3	2	1
Quality of Requested Microgravity Level:	5	4	3	2	1
Duration of Requested Microgravity Level:	5	4	3	2	1
Overall Satisfaction:	5	4	3	2	1

Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**C-9 Experiences**

How many times have you flown on the C-9 microgravity aircraft? \_\_\_\_\_

On a scale of 1 to 5, rate your experiences on the C-9 aircraft. Space is provided for further comments.

	Excellent	Good	Acceptable	Poor	Unsatisfactory
Safety:	5	4	3	2	1
Overall Success of Experiment:	5	4	3	2	1
Quality of Requested Microgravity Level:	5	4	3	2	1
Duration of Requested Microgravity Level:	5	4	3	2	1
Overall Satisfaction:	5	4	3	2	1

Comments: \_\_\_\_\_  
 \_\_\_\_\_

**Both 727 and C-9 Experiences**

1. Please explain how the delivery of microgravity flight services and your ability to successfully conduct your experiments were similar or different on the two aircraft.

\_\_\_\_\_

2. Please explain if you prefer one aircraft over the other?

\_\_\_\_\_

**Questions regarding payments**

1. How much did or will you/your organization pay for this flight? \_\_\_\_\_

2. What criteria or basis was used to determine how much you/your organization would be charged to fly your experiment(s)?

\_\_\_\_\_

3. Please explain if the current price that you/your organization pay is a deterrent to flying experiments in the future?

\_\_\_\_\_

4. Do you feel your funds were well spent on this flight? Please explain why.

\_\_\_\_\_

**Additional comments:**

\_\_\_\_\_

\_\_\_\_\_

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## JOHNSON FCOD RESPONSE

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National Aeronautics and  
Space Administration  
  
Lyndon B. Johnson Space Center  
2101 NASA Parkway  
Houston, Texas 77058-3696



December 18, 2008

Reply to Attn of: CA-08-35

TO: NASA Headquarters  
Attn: Associate Administrator for Space Operations Mission Directorate  
THRU: AA/Center Director, Johnson Space Center  
FROM: *Michael P. Jett*  
CA/Director, Flight Crew Operations  
SUBJECT: C-9 Transition to Flyable Storage

The purpose of this letter is to articulate the recommended plan for transitioning NASA 932, the C-9 aircraft operated by the Flight Crew Operations Directorate (FCOD) at the Johnson Space Center (JSC), to flyable storage in accordance with the November 19, 2008 Strategic Management Council decision to commercialize microgravity flight services. This plan does not address consolidation of commercial microgravity flight services project management at JSC.

NASA 932 will be placed in flyable storage at Ellington Field Texas not later than January 1, 2009. The cost for flyable storage will be funded by the Space Operations Mission Directorate (SOMD). NASA 932 will be maintained in a flyable condition with the capability for future use as determined by requirements approved and funded by SOMD. External (non NASA) customer use of the aircraft for missions other than microgravity flight services may be considered, evaluated, and approved by SOMD on a cost reimbursable basis. NASA 932 will remain in flyable storage in a manner that will not preclude future exchange sale to recoup costs.

Flyable storage assumes no other uses for this aircraft at this time. Alternate methods of accomplishing Space Shuttle Program support requirements, such as astronaut heavy aircraft flight training and pathfinder mission support flights, will be evaluated by FCOD and SOMD/Space Shuttle Program as required. Emergency use of the aircraft in direct support of hurricane evacuation may be considered and approved by the Associate Administrator for Space Operations Mission Directorate or the Center Director, Johnson Space Center.

This plan will be managed by FCOD as a Cost Account Manager for the SOMD Human Spaceflight Crew Operations account. FY 2009 FCOD costs estimates for flyable storage will be provided to SOMD not later than January 15, 2009. Future estimates will be provided to SOMD through the normal budget review processes.

With your concurrence and approval, FCOD will immediately implement this plan.

A handwritten signature in black ink, appearing to read "Brent W. Jett".

Brent W. Jett

cc:  
See List

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## MANAGEMENT COMMENTS

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



June 14, 2010

Reply to Attn of: Space Operations Mission Directorate

TO: Assistant Inspector General for Auditing

FROM: Associate Administrator for Space Operations

SUBJECT: Response to Office of Inspector General's (OIG) Draft Audit Report,  
"Review of National Aeronautics and Space Administration's (NASA)  
Microgravity Flight Services, S-09-008-01"

We have reviewed the subject draft audit report and are providing our comments to be included in the consolidated Agency response. We also acknowledge the section of the report which succinctly provides a history of NASA's microgravity flight services, and the resultant actions taken by NASA. Actions taken in response to specific recommendations are discussed below:

**Recommendation 1:** *"Recommend that the Johnson Director of Procurement negotiate a revised performance-based payment structure to provide greater incentives for the contractor to deliver consistent, high-quality microgravity flight service."*

**Response:** Concur with the intent. As discussed with your audit team during the course of the data gathering, the procurement was conducted on a competitive basis. We are in the third year of the contract and restructuring at this point in time is not feasible for the following reasons: The Government has no authority to mandate such a restructure of fee without mutual consent of the parties; there is no incentive for the contractor to renegotiate the payment structure to provide consistent, high-quality microgravity flight services; the Government would be in a position of weakness in negotiations and would likely have to provide some sort of consideration for a change of this magnitude; additionally, modifying the fee structure at this point in the contract would be inconsistent with the basis and integrity of the original competition. Although it is not practical to do so at this time, we intend to redefine the payment structure during development of the follow-on microgravity contract procurement strategy to ensure customers pay only for consistent, high-quality parabolas. Based on this plan of action, we ask this recommendation be closed on issuance of the report as there is no advantage in keeping the recommendation open until a new contract award.

**Recommendation 2:** *"The Associate Administrator for SOMD should direct the Johnson FCOD to develop a formal risk management plan that identifies specific options to maintain NASA's access to microgravity flights if Zero G ceases providing microgravity flight services. Such analyses should include the cost of identifying another commercial contactor as well as the cost of maintaining the C-9 aircraft for operation use."*

**Response:** Concur with the intent. FCOD will formally document a risk management plan via the Integrated Risk Management Application (IRMA), JSC's risk management system, and identify specific options, as well as costs, safety and schedule considerations, to maintain access to microgravity flights in the event Zero G ceases to provide these services. Because microgravity services is not a "major" program within FCOD with respect to budget and resources, it is appropriate to use IRMA for the purposes of risk management and documentation of the management plan. IRMA will achieve the same desired effectiveness and results that the NASA IG intends per this recommendation. We will provide your office documentation showing the plan and request closure of the recommendation by October 1, 2010.

**Recommendation 3:** *"The Chief for Glenn's Procurement Division should review its internal controls for payments to contractors and modify its controls and procedures to detect and prevent errors like those to Zero G when calculating payments to contractors."*

**Response:** Concur. GRC will instruct its Contracting Officers (CO) with similarly complex pricing arrangement to have the Contractor independently price the required services and have the CO verify the pricing against the contract terms and conditions before issuing the approval for payments."

We acknowledge the hard work and professionalism of the NASA OIG in this recent audit. We appreciate the expertise and insights provided by the OIG on this matter. If you have any questions regarding these comments, please contact the Headquarters point of contact for this audit Mr. Julius Edelmann on (202)-358-1826 or via email at: [j.edelmann@nasa.gov](mailto:j.edelmann@nasa.gov).

  
William H. Gerstenmaier

cc:  
Headquarters  
SOMD/William Gerstenmaier  
SOMD/Lynn Cline  
SOMD/Julius Edelmann  
SOMD/Tonya Brown  
SOMD/Jonathan Krezel

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C000/Robyn Gordon  
CH00/Bradley Baker

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BA111/Debra L. Johnson  
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    Director, Flight Crew Operations Directorate, Johnson Space Center

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House Committee on Oversight and Government Reform  
    Subcommittee on Government Management, Organization, and Procurement  
House Committee on Science and Technology  
    Subcommittee on Investigations and Oversight  
    Subcommittee on Space and Aeronautics

Major Contributors to the Report:

Raymond Tolomeo, Acting Director, Space Operations Directorate

Kenneth Sidney, Project Manager

Connia Webb, Team Lead

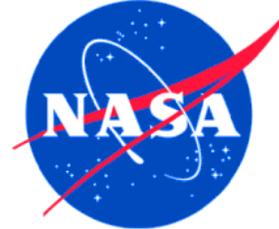
Dennis Clay, Auditor

Ellis Lee, Auditor

Lawrence Neu, Aerospace Technologist

JUNE 18, 2010

REPORT No. IG-10-015



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NASA Headquarters  
Washington, DC 20546-0001

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