
Office of Inspector General
Audit Report

**GREATER ADHERENCE TO ADS-B CONTRACT
TERMS MAY GENERATE BETTER PERFORMANCE
AND COST SAVINGS FOR FAA**

Federal Aviation Administration

Report Number: AV2017075
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U.S. Department of
Transportation
Office of Inspector General

Memorandum

Subject: **ACTION:** Greater Adherence to ADS-B Contract Terms May Generate Better Performance and Cost Savings for FAA
Federal Aviation Administration
Report Number AV2017075

Date: September 5, 2017

From: Charles A. Ward 
Assistant Inspector General for Audit Operations
and Special Reviews

Reply to
Attn. of: JA-2

To: Federal Aviation Administrator

In 2007, the Federal Aviation Administration (FAA) awarded a more than \$1.8 billion contract¹ to develop and implement the Automatic Dependent Surveillance Broadcast (ADS-B) surveillance system. ADS-B is a foundational component of FAA's transition to the Next Generation Air Transportation System (NextGen). FAA envisions ADS-B eventually becoming its principal means of aircraft surveillance. As required by the contract, the contractor installed a nationwide network of ground-based radios. These radios receive broadcasts from ADS-B equipped aircraft that identify the aircraft's position, and the ADS-B radio network transmits the data to air traffic control facilities. FAA has mandated that all aircraft (with certain exemptions) must be ADS-B equipped by 2020. As of November 2016, according to FAA data, about 750 U.S. commercial aircraft have been equipped so far—about 11 percent of all aircraft that will need to be equipped under the mandate.

As required by the FAA Modernization and Reform Act of 2012, we reviewed FAA's award and oversight of the ADS-B contract. Our audit objectives were to determine whether (1) the ADS-B contract provides FAA the ability to monitor whether the contractor is providing required ADS-B products and services; and (2) FAA's procedures are adequate for determining whether payments to the contractor are reasonable. We also examined any lessons learned from the ADS-B acquisition that could strengthen future procurements.

¹ The contract (DTFAWA-07-C-00067) was awarded to ITT Corporation. In 2011, ITT became Exelis and was acquired in 2015 by Harris Corporation.

We conducted this audit in accordance with generally accepted Government auditing standards. Exhibit A details our scope and methodology.

RESULTS IN BRIEF

The ADS-B contract provides FAA the ability to monitor whether the contractor is providing required ADS-B products and services. However, FAA has made only limited use of these provisions. For example, while the ADS-B contract identifies seven specific measures for evaluating ADS-B performance, and specifies that the contractor should validate that all seven requirements are being met, FAA required reports from the contractor on only three of the seven measures—availability, latency, and update rate.² Without full reporting, FAA cannot know whether the ADS-B products and services being provided meet all contractual requirements. In addition to contractor reporting, the Agency uses a monitoring tool known as the Surveillance Broadcast Services (SBS) Monitor to collect data on ADS-B performance to independently validate the contractor's self-reporting. However, the SBS Monitor collects data on the same three performance requirements about which the contractor reports, though its capabilities could be expanded. Separately from monitoring system performance, system acceptance testing was conducted in each geographical region, known as a service volume, where the ADS-B contractor provides required services. However, at the time of testing, FAA had not yet completed installing ADS-B in at least 47 service volumes. Nevertheless, FAA accepted the partial installations, even though the contract acceptance criteria provide that the contractor verify complete installation before acceptance.

The ADS-B contract contains provisions that can help FAA ensure that payments are reasonable. However, FAA did not implement procedures to effectively use these contractual tools. First, FAA did not seek adjustments to service volume subscription fee payments when the contractor decided to use shared radio stations that support multiple service volumes. Second, FAA could have negotiated an incentive plan that did not require the Agency to pay full subscription fees plus make incentive payments even when significant availability outages occurred. For example, we found that FAA awarded performance incentive fees amounting to 6.7 percent of the subscription fees in 2015, although for 6 months ADS-B overall did not meet the minimum availability requirements of the contract. Third, FAA has not enforced a contract provision requiring the contractor to track and bill capital assets separately, although it now says it will start to do so. Without knowing these costs, FAA cannot determine whether equipment and installation prices for installations are reasonable. As a result of these issues, FAA cannot ensure that the millions of dollars in payments it makes to the contractor each month for ADS-B service are reasonable. Additionally, applying lessons learned

² The remaining four measures are capacity, integrity, coverage, and independent validation (ADS-B Contract, Part I, Section C. Subsection 4.1.1.1.2).

from the ADS-B acquisition can strengthen FAA's ability to better ensure a reasonable firm fixed price when awarding future complex contracts.

We are making several recommendations to improve FAA's abilities to oversee ADS-B performance, manage the contract more effectively, and pursue pricing adjustments, which may result in cost savings.

BACKGROUND

In 2007, FAA awarded a contract to ITT Corporation for \$1.8 billion—if all options are exercised through 2025—to develop and deploy the ADS-B ground infrastructure and start broadcasting services. The total life-cycle cost through 2035 of the ADS-B effort and related surveillance broadcast service costs is estimated to be about \$4.4 billion. This includes more than \$2 billion in costs not yet formally incorporated into the program's baseline.

Since awarding the ADS-B contract in August 2007, FAA has primarily focused on deploying the ground infrastructure for receiving and broadcasting information. When FAA declared the system completed in April 2014, the infrastructure consisted of about 634 radio stations distributed in more than 300 service volumes nationwide.

The ADS-B contract is a hybrid of a cost-plus and fixed-price arrangement. The contract established that the ADS-B program would be implemented in two segments:

- Segment 1 established the ground infrastructure for five key geographical areas called service volumes. Segment 1 is administered in part under a cost-plus incentive fee agreement in which FAA covers the cost and fee for effort performed by the contractor.
- Segment 2 provides equipment and installation needed for more than 300 service volumes. Segment 2 is administered under a firm fixed-price arrangement in which FAA pays the contractor a fixed monthly fee for meeting service requirements after completion of successful system acceptance testing.

The contract is service-based, meaning FAA does not own or maintain the hardware, software, or other ground infrastructure. In a more traditional acquisition, FAA would own and maintain the majority of the equipment.

FAA MONITORING DOES NOT ENSURE ALL ADS-B PERFORMANCE REQUIREMENTS ARE BEING MET

FAA has not taken full advantage of provisions in the ADS-B contract to monitor the contractor's performance and ensure ADS-B meets all performance requirements. For example, FAA does not require its contractor to report on all seven ADS-B performance level requirements included in the contract. In addition, while FAA has developed an independent monitoring capability, the monitoring system measures the performance of the same three technical performance measures for which the contractor reports. Moreover, in at least 47 service volumes, FAA accepted and paid for the partial ADS-B installations, even though the contract acceptance criteria calls for complete installation before starting payments. As a result, FAA paid the contractor for these partial installations even though ADS-B performance levels agreed upon in the contract were not being met.

FAA Does Not Require the Contractor To Report on All ADS-B Performance Requirements

FAA's ADS-B contract identifies seven specific service performance levels that the contractor must adhere to in implementing the ADS-B system (see table 1). The contract also specifies that the contractor should assure FAA that the ADS-B system is meeting all seven of the performance level requirements, although during the course of this audit, the Agency was only requiring measurement and reporting on three of them.³ These three requirements—availability, latency, and update interval—are known as Technical Performance Metrics (TPMs).

³ At the conclusion of this audit, FAA was negotiating terms with the vendor to provide a formal artifact by which additional system characteristics, including the seven service performance levels, can be tracked.

Table 1. ADS-B Performance Level Requirements

Metric	Definition
Availability	The probability of the service performing its required function at the initiation of the operation.
Capacity	The ability to process and output service reports for all received messages in a specified service volume.
Coverage	The service provided throughout a specified service volume taking into account traffic densities and maximum interference.
Independent Validation	The ability to independently determine the location of a target (i.e., aircraft) within the specified required time.
Integrity	The probability of the service introducing a system target error.
Latency	The processing delay between the time of reception of a message at the system receiver and the reception/transmission of the corresponding message at the Service Delivery Point (SDP). ⁴
Update Interval	The time between successive position reports sent to each SDP for a specific aircraft/vehicle.

Source: OIG analysis of FAA documents.

By focusing only on three technical performance metrics, FAA was monitoring whether an aircraft's messages are successfully broadcast in a timely manner. By not receiving reports on the other metrics, such as capacity and coverage, FAA could not know whether the network will be able to manage the volume of messages transmitted when large numbers of aircraft try to use the system.

Although 9 years have passed since contract inception, FAA did not begin collecting all contractually required performance reports until August 2015, after we called FAA's attention to this shortcoming. More specifically, the ADS-B contract contains a requirement⁵ that the contractor submit a monthly service performance report that includes current and historical trends on all the performance level requirements listed in table 1. Consequently, FAA has lacked data that is contractually available at no cost to the Government about the ADS-B system's performance that may have revealed system problems. While FAA is collecting these reports, the reports do not yet provide data on all metrics. FAA states that it plans to require these data in future reports.

FAA's Independent Monitoring System Does Not Monitor for All ADS-B Service Requirements

To provide independent oversight of the ADS-B infrastructure, FAA developed the SBS Monitor. Deployed at two locations, the FAA Aeronautical Center in Oklahoma City, OK, and the FAA Technical Center in Atlantic City, NJ, the Monitor is a tool intended to assess the performance and operational safety of the

⁴ The service delivery points are the physical demarcation points between the services and the systems which ultimately use the data on the ground.

⁵ ADS-B contract, Part I, Section C, Subsection 4.1.2.5.8

ADS-B ground equipment at each ADS-B site to help avoid and resolve outages. However, the SBS Monitor only measures performance of the same three of seven ADS-B performance requirements that the contractor reports. As a result, FAA's independent monitoring system does not verify that the service provided is meeting all performance requirements, though it could be modified to do so, according to FAA. FAA officials also stated that using the SBS Monitor in combination with the contractor's monthly reports provides sufficient monitoring of the contractor's performance. In our opinion, since the contractual purpose of the Monitor is to provide independent validation of the contractor's performance, FAA would benefit by having the Monitor provide data on all seven performance measures.

FAA's Acceptance Testing Process Was Limited

We also identified limitations in the testing process used to determine whether the contractor met all requirements before FAA accepted ADS-B systems and began monthly subscription fee payments. Specifically, the ADS-B contract required the contractor to conduct an Implementation Service Acceptance Test (ISAT) at each service volume after complete installation.⁶ However, while the ADS-B system needs to run continuously to meet FAA requirements, ISAT provides only a snapshot of ADS-B performance. While we recognize that FAA performed additional tests on requirements, these tests were performed after the ISATs were conducted and after FAA accepted the ADS-B service volume.

We identified a number of limitations with FAA's ISATs for ADS-B. For example:

- FAA could not conduct a specific test for integrity as part of the ISAT, even though integrity is one of the seven service performance requirements identified in the contract. FAA does not dispute this limitation; however, according to FAA officials, integrity was tested in factory acceptance tests conducted at the contractor's facility.
- FAA limited flight tests for ISATs to verify ADS-B coverage to key site and en route service volumes, and conducted tests 5,100 feet above the surface, although the contract defines the coverage ceiling for en route service volumes as 60,000 feet. Hence, FAA cannot be sure based on ISAT results that coverage requirements are being fully met between 5,100 and 60,000 feet. According to FAA officials, complete testing would be prohibitively expensive, so upper altitude tests and detailed individual radio station coverage analyses were performed where needed.

⁶ ADS-B contract, Part I, Section C, Subsection 4.1.7.3.2

- FAA did not conduct flight tests during the ISATs to verify ADS-B coverage for terminal service volumes, although FAA’s intent is to eventually use ADS-B to separate aircraft in terminal airspace. According to FAA, every en route and terminal service volume underwent a separate flight inspection as part of the implementation system test performed after the system was accepted (after ISAT).
- FAA performed ISAT coverage tests using “targets of opportunity”—aircraft that happened to enter the service volume airspace during the ISAT and which were also equipped with ADS-B. During the period of the ISAT tests, we determined that the ADS-B equipage rates for rule-compliant⁷ aircraft were about 0.2 percent in 2012 and rose to slightly more than 5 percent by 2014. As a result, the ISAT tests were not adequate to show whether procedures for proper coverage and latency and update intervals can be met in a future “all-aircraft equipped” environment. FAA officials point out that there were additional pre-rule aircraft used during the test period which were valid for assessing coverage, latency, and update intervals. However, rule-compliant aircraft are necessary for verifying critical services.⁸
- Additionally, for terminal service volumes, FAA verified certain coverage measures during ISATs indirectly. For example, while downlink (transmissions from ADS-B targets to ADS-B ground stations) coverage was tested and verified using targets of opportunity, uplink (transmissions from ADS-B ground stations to ADS-B targets) coverage was not tested, and “inferred” instead due to lack of flight test data. FAA notes that flight tests performed for en route service volumes in some cases also covered terminal service volumes, and that subsequent flight inspections were performed during implementation service tests after the system was accepted. However, these points do not contradict that the ISATs had limitations.
- Availability—another requirement—was not measured in the ISATs directly because of the ISAT’s short duration (typically 3 days). Statistically significant measures of availability could not be verified at contractually required levels (i.e., 99.999⁹ percent for critical services and 99.9¹⁰ percent for essential services). While FAA conceded that the ISATs were limited in duration, FAA

⁷ To be rule-compliant with FAA’s ADS-B mandate (14 CFR § 91.227), ADS-B avionics must meet minimum operational performance standards as defined by the RTCA, a Federal advisory committee. RTCA standard document DO-260B is for major air carriers operating in the 1090 MHz frequency, and DO-282B is for general aviation users operating in the 978 MHz frequency.

⁸ Essential services (Traffic Information Service- Broadcast (TIS-B) and Flight Information Service- Broadcast (FIS-B) are used by pilots as advisory information, whereas critical services (ADS-B and ADS-Rebroadcast) are used by to separate and manage aircraft.

⁹ ADS-B contract, Part I, Section C, Subsection 4.1.1.2.2

¹⁰ ADS-B contract, Part I, Section C, Subsection 4.1.1.3.2

also stated that it monitored availability through the SBS Monitor. However at the time of the ISAT, the monitoring data was not considered for acceptance.

Because of these ISAT limitations, FAA did not have a full picture of ADS-B's performance and could not be assured that ADS-B is meeting all contractual requirements.

FAA Accepted and Made Partial Payments for Incomplete Installations

Despite the limitations in the ISAT testing, FAA accepted partially completed installations in at least 47 service volumes, and began making partial payments, even though the contract provides that installations should be complete prior to acceptance and partial deliveries should be separately priced in the contract and these were not. For example, for the Los Angeles service volume, after the contractor delivered 14 of 25 planned radio stations, FAA accepted the system and began paying 65 percent of the subscription fees in October 2010. In September 2011, FAA increased the partial payment rates to 90 percent after the contractor reached 20 of 25 planned radio stations. Overall, FAA paid \$29.8 million for partially completed installations across all service volumes.

FAA's decision to accept and pay for partial installations raises several concerns:

- First, while the ADS-B contract allows for partial payments for acceptance of partial deliveries, the clause also provides that the price must be separately stated in the contract.¹¹ However, the contract includes no such separate pricing. Additionally, although the contract provides that before accepting the system, service acceptance tests should be performed to verify complete installation, FAA performed acceptance tests on less than complete installations. Taken in combination, FAA's decision to test and accept partial infrastructure and to pay partial prices not stipulated in the contract diminished its contractual acceptance rights. In our opinion, FAA's modified partial acceptance approach appears to have evolved through correspondence between the contracting officer and the contractor, although it has been difficult to determine what the parties have agreed to because contract documentation was incomplete.
- Second, absent separate pricing in the contract for partial installations, FAA's method for arriving at the amount for these partial payments was questionable. According to FAA officials, it paid prorated service charges

¹¹ ADS-B contract, 3.3.1-1: The FAA shall pay the Contractor, upon the submission of proper invoices, the prices stipulated in this contract for supplies delivered and accepted or services rendered and accepted, less any deductions provided in this contract. Unless otherwise specified, payment shall be made upon acceptance of partial deliveries or any portion of the work delivered or rendered for which a price is separately stated in the contract.

based on the proportion of radio stations required in a service volume to meet complete service volume performance requirements. FAA could not know at partial installation whether the performance requirements for a fully completed service volume could be met with the number of radio stations planned until the final ISAT test was performed. In our opinion, the only way FAA could ensure that contractual performance would be met was to test the service volume with complete installation as called for in the contract.

- Third, when FAA began paying the contractor for partially completed service volumes, it was essentially advancing payments to the contractor prior to the system meeting performance requirements, which could not be fully demonstrated because installation was incomplete. For example, in Seattle, FAA began paying the contractor 75 percent of the subscription fee, even though the contractor's testing identified 22 deficiencies, 15 of which were the result of the contractor initially delivering 20 instead of the 29 radio stations identified for the service volume.

In conclusion, the effect of reimbursing the contractor for its costs for incomplete installations over extended periods, even on a prorated basis, is that FAA was doing so without adequate support that the contractor was meeting contractual and performance requirements.

FAA'S PROCEDURES ARE NOT ADEQUATE FOR DETERMINING WHETHER PAYMENTS TO THE CONTRACTOR ARE REASONABLE

Although the ADS-B contract includes provisions and procedures that could assist FAA in determining whether payments made to the contractor have been reasonable, FAA has not effectively used these tools. For example, FAA has not assessed the potential for service volume subscription fee adjustments or savings based on which radios are being used in the service volume. FAA is also paying monthly subscription fees despite system performance gaps and negotiated an incentive agreement that pays additional amounts on top of monthly subscription fees. FAA also did not request a price adjustment when fewer radio stations were delivered than priced in the contract due to design changes. These past shortfalls in oversight and contract management point to areas where FAA can do more to ensure payments are reasonable.

FAA Did Not Assess the Potential for Subscription Fee Adjustments or Savings

Since completing service volume acceptance testing several years ago, FAA made numerous payments without assessing whether to pursue adjusting the fee structure supporting these payments based on the actual infrastructure the

contractor is using in each service volume. For example, for the Los Angeles service volume, the contractor installed fewer radio stations than planned to achieve ISAT and borrowed ADS-B service capability from radio stations installed at adjacent service volumes. Specifically, 25 radio stations were planned for Los Angeles, but the contractor only installed 20. Subsequently, the contractor passed acceptance testing by sharing radio stations from neighboring service volumes—in this case, one radio from the adjacent Oakland service volume, and four radio stations from the adjacent Albuquerque service volume—and adding one more radio station in Quartzite, AZ. However, FAA did not assess the potential for subscription fee adjustments based on the reduced number of radio stations installed in the Los Angeles service volume. FAA’s explanation for not adjusting subscription fee pricing is that the Agency pays for ADS-B services and that any efficiencies or inefficiencies resulting from the contractor’s implementation and operation do not affect the fixed price subscription fees established in the contract.

The ADS-B contract recognizes specifically that the contractor may share radio stations from adjacent or differing types of service volume (e.g., between en route and terminal) to satisfy contractual performance requirements. However, a contract clause that permits shifting the allocation of the costs of a shared radio station between service volumes establishes intent to assign the cost of a radio station to only one service volume.¹² It further confirms that the contractor-established pricing is based on assumptions regarding the number of radio stations that would be shared. As these assumptions changed and less infrastructure was installed, FAA did not address the discrepancies by seeking to renegotiate subscription fees for affected service volumes. Therefore, for instance, the prices for Oakland, Albuquerque, and Los Angeles, each, are being billed using the full subscription fee prices that were originally agreed upon and included in the contract’s pricing matrix, despite the increased reliance in those service volumes on shared radio stations and corresponding reduction in planned infrastructure. After our discussion with FAA officials about assignment of costs for shared radio stations, they agreed to conduct and document an analysis to determine whether duplicate subscription fee payments are being made due to radio stations that support multiple service volumes.

FAA Is Paying Subscription Fees Despite System Performance Gaps

FAA is planning to pay the contractor approximately \$1.8 billion in total contract costs through 2025, and paid about \$967 million to the contractor for ADS-B services through October 2015 (see table 2).

¹² ADS-B contract, Section H.13

Table 2. ADS-B Contract Costs Through October 2015

	Subscription Fees	Other Costs^a	Total Costs
Total planned payments to the contractor	\$1.45 billion	\$350 million	\$1.8 billion
Amount paid to the contractor through 10/15	\$594 million	\$373 million	\$967 million

^aThe “Other Costs” primarily represent costs incurred in Segment One, CLIN 0001 under a Cost Plus Incentive Fee contract type and other CLINs that are not billed through fixed price subscription fees.

As of October 2015, FAA was being billed monthly subscription fees for approximately 300 service volumes. Yet, FAA has paid the full subscription fees even when minimum requirements have not been met in some service volumes. FAA officials stated that they penalize the contractor for performance gaps by computing disincentives on an individual service volume basis. However, a service volume’s subscription fees are not reduced when performance is unsatisfactory.

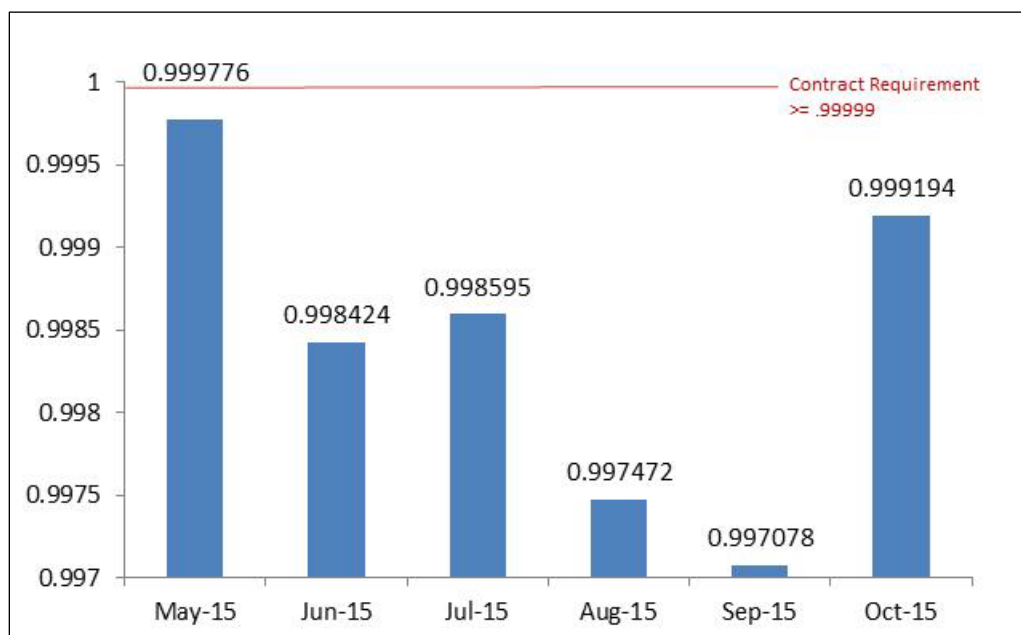
FAA pays subscription fees monthly according to the contract’s stated price. Then quarterly, FAA computes incentives and disincentives based on the contractor’s performance. Using contract modifications with a separate pool of funds, FAA makes funding adjustments to the contract to apply the system-wide effect of the contractor’s earned incentives and disincentives. According to our analysis, however, only in very few instances have the net effect of these quarterly adjustments negatively impacted the overall incentive fee. When they have impacted the incentive fee, in our opinion the amounts have been inconsequential. According to FAA, if the Agency recognizes performance gaps, the contractor generally earns fewer incentives for that quarter due to disincentives being subtracted from the potential incentives that can be earned for that quarter. Nonetheless, this incentive fee framework allows full subscription fees to be paid, even when there are performance gaps.

Furthermore, FAA’s process for calculating disincentives may not capture all performance issues. FAA has developed a process for determining incentives and disincentives that involves consideration of performance data from its own SBS Monitor and data reported by the contractor. A Performance Control Board (PCB) meets and considers these data and any other available internal data and makes an award determination by reconciling the data. However, we found numerous ADS-B availability outages that were reported by the SBS Monitor that were not included in the PCB’s reconciliation. For example, for July 2015, the SBS Monitor reported 163 outages, but only 50 of the outages reported by the SBS Monitor and the contractor (combined) were included in the PCB’s

reconciliation report. As a result, it is not clear whether FAA is factoring in all outages that should be considered in calculating its disincentive payments. In response to our questions about its reconciliation practices, FAA officials stated that they assess all outage reports. However, in our analysis of documentation provided to us by FAA, it was unclear why some outages were not included in incentive calculations, since all were assessed.

Moreover, on a system-wide basis, FAA's independent SBS Monitor is consistently reporting that ADS-B is not meeting the minimum performance requirement for system availability of 0.99999, as required by the contract. For example, the contractor did not reach the minimum performance requirement for availability of ADS-B services for 6 months between May 2015 and October 2015, as illustrated in figure 1.

Figure 1. ADSS* Service Availability From All Operating Service Volumes



* ADSS refers to the ADS-B surveillance system.

Source: OIG analysis of FAA service availability data. Based on SBS Monitor provided data.

According to FAA program officials, availability was reduced for this period because the contractor was performing planned system upgrades, and the SBS Monitor data overstates availability shortfalls because it includes all outages, both unplanned and planned. FAA does not believe planned outages should be included. However, the ADS-B Critical Services Specification in the contract's performance work requirements and required documents sections require that

accounting for *all* outages should be included when measuring performance.¹³ In discussion with FAA officials about their contract interpretation, they stated that they plan to amend the critical specification portion of the contract to exclude scheduled maintenance when measuring operational availability. Revising the calculation methodology will result in an increase in ADS-B's measured availability each month. Consequently, as we understand FAA's proposed change, it will reduce the performance requirements of the contract.

Moreover, while FAA officials stated most outages were attributable to system upgrades, we found that most availability outages were for unscheduled outages. Specifically, 556 of 796 outages reported by the SBS Monitor for this period were unscheduled. Upon reviewing more current data for the 6 months ended June 2016, we found that some improvement has occurred; however, the reported SBS data indicate that the ADS-B system as a whole was still not reaching 0.99999 of availability.

Despite the large number of unscheduled outages identified, we found that FAA awarded a performance incentive fee of 6.7 percent of subscription fee amounts, out of 7 percent available, for the referenced 6-month period of May through October 2015. As explained above, FAA's exclusion of scheduled maintenance and upgrades from ADS-B availability computations for incentive payments contradicts the critical service specification of the contract. However, as also described above, FAA officials stated they intend to modify that specification. Since we found a difference between the critical service specification and the incentive fee plan, we looked at the intent of the parties when the contract was formed. Specifically, FAA's Source Selection Technical Evaluation Report and the Source Selection Official's decision documentation, as well as the contractor's proposal, indicate that no down time would occur for planned outages or system upgrades. The source selection documents indicate that this was a reason for awarding the contract to ITT (Exelis). As a result, the extent of the outages that are occurring for planned maintenance was not anticipated when FAA finalized its technical performance measures and awarded the contract.

According to FAA program officials, rather than use the results of the Agency's independent SBS Monitor, a more accurate way to determine whether ADS-B is meeting the contract availability requirements is to use the ADS-B PCB¹⁴ monthly reconciliation reports to measure outages. However, even the PCB reconciliation reports indicate that critical availability requirements are not being

¹³ FAA-E-3011, Revision A, Critical Services Availability Specification for Surveillance Systems version 1.2, section 3.3.2.2.6 and 3.1.22, as referenced on page 10, Section 3.1, Applicable Documents, Government Documents, of the contract; and Section 4.1.1.2.2, Performance, page 18, of the contract. The ADS-B service is a safety-critical service as classified by NAS-SR-1000 for surveillance services.

¹⁴ This board, made up of FAA officials and the contractor, meets monthly to discuss ADS-B performance and creates reports to calculate incentives and disincentives.

met. For example, the December 2015 reconciliation report states that availability was 0.997 when both scheduled and unscheduled outages are included in the calculation, and 0.9973 when excluding scheduled outages for the 12 month period ending November 2015—both below the required 0.99999 for the 12 months ended November 2015. Thus, even when scheduled outages are removed from the incentive calculation, the contractor did not meet the contract's critical availability requirement of 0.99999 for the timeframe identified in figure 1. Nevertheless, FAA paid 100 percent of the subscription fees as well as a performance incentive fee for the period in question.

FAA Has Not Effectively Used Incentive Payments To Enhance Contractor Performance

FAA's incentive plan for the ADS-B contract is inadequately structured and administered. For example, the ADS-B incentive targets are the same as the minimum technical performance requirements in the contract. In addition, FAA did not negotiate the incentive plan in a timely manner, made some incentive payments without supporting performance data, and has not disclosed the total potential incentive amount in the contract. As a result of these shortcomings, FAA's use of incentives to encourage improved contractor performance has been ineffective.

FAA Is Incentivizing the Contractor To Meet Minimum Performance Requirements

According to FAA's Acquisition Management System (AMS) and Federal Acquisition Regulations (FAR),¹⁵ incentives should be structured to motivate a contractor to *exceed* the minimum contract performance requirements by establishing performance targets above the minimum requirement. However, FAA established performance targets for incentive fee payments that are the *same* as the minimum requirements in the contract.¹⁶ This means that FAA is incentivizing the contractor to meet the minimum performance requirements of the contract. According to FAA officials, its minimum availability requirement of .99999 is so stringent, allowing for less than 30 seconds per month of downtime, that there is little room for improvement. Moreover in FAA's opinion, the incentive and disincentive plan is used to motivate optimal performance by the contractor. FAA further stated that the incentive and disincentive provisions defined in the contract have been effective in managing contractor performance. Yet, our findings show that FAA is paying incentives even when the contractor is not meeting the minimum requirement.

¹⁵ When pre-determined, formula-type incentives on technical performance or delivery are included in the contract, increases in profit or fee are provided only for contractor achievement surpassing the targets, and decreases are provided for the extent that such targets are not met. The incentive increases or decreases are applied to performance targets rather than minimum performance requirements.

¹⁶ ADS-B contract, Section H.7, Incentives/Disincentives Regarding Contract Performance

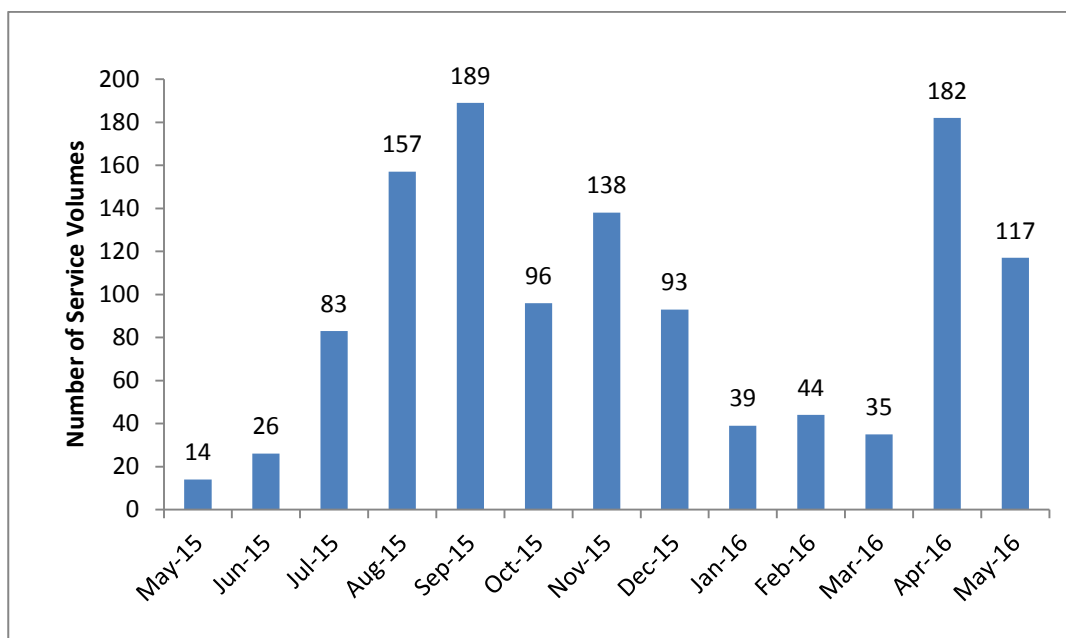
Since the first few contract years, FAA has consistently paid near the maximum incentive fee rate of 7 percent of the monthly subscription fee for each service volume, even when minimum system-wide performance requirements were not met, and outages increased in some service volumes. Overall, rather than reduce the subscription fee payments, FAA's application of disincentives merely reduces the size of the cumulative incentive fees.

ADS-B Outages Have Fluctuated Widely, Despite Incentives

As of June 2015, FAA had awarded \$22.3 million in incentive payments (near the maximum possible payout of 7 percent in incentive fees for most years). Based on our review of FAA performance data, it is unclear whether incentives have encouraged the contractor to improve performance. For example, between May 2015 and May 2016, the number of service volumes with service availability outages (planned and unplanned) fluctuated widely, according to FAA's independent SBS Monitor's reports.¹⁷ (See figure 2.) Wide fluctuations in performance, despite payment of incentive fees near the top of the possible range, in our opinion, suggest there is no relationship between additional rewards given to the contractor and the contractor's performance. As the contract states, incentives and disincentives should motivate not only adherence with the specifications but also minimization of service performance violations in terms of magnitude, duration, and breadth. While acknowledging the wide fluctuations in performance, FAA suggested this alone does not mean the incentives are not encouraging the contractor to seek improvement. In our opinion, though, incentive payments over time should result in improved performance.

¹⁷ Incentive awards are separately computed for ADS-B, TIS-B, and FIS-B service at each of approximately 300 service volumes. Incentives are paid unless an annual time limit for service outages is exceeded for availability. The payment under each type of service includes 3% for availability, 2% for latency, and 2% for update interval for a total of 7%.

Figure 2. ADS-B Service Volumes With Service Availability Outages



Source: SBS Monitor Report

According to FAA, the data in figure 2 were influenced by planned outages experienced due to the contractor's desire to improve the system at its own expense, including a cutover to a private network from a semi-private network. However, this improvement was necessary to meet the requirements of the contract.

FAA Has Not Included Planned Incentive Payments in Its Total Contract Costs

FAA has not identified the potential dollar value of incentive fees that may be awarded as part of its contract. While the contract subscription fees are fixed, the incentive awards are made from funds above and beyond the subscription fee amounts. When we asked what the Agency planned to pay in incentive fees, FAA officials stated that the contract value could increase by about \$55.7 million above the \$22.3 million in incentive payments already made.¹⁸ Stating an estimated dollar amount of potential incentives would provide external stakeholders, such as the Office of Management and Budget (OMB) and Congress, with important information concerning the true acquisition cost for ADS-B, including incentive payments.

By following FAA and Federal guidance providing that incentive fees to motivate the contractor be based on performance exceeding minimum targets,

¹⁸ FAA estimated the remaining payments by applying an estimated incentive rate to the estimated subscription fee amounts for the period beginning with the third quarter 2015-2025.

FAA could put about \$55.7 million in remaining estimated incentive fee funds to better use. For example, performance measures for paying incentives that address all key technical requirements could enhance performance outcomes. In addition, reducing or eliminating incentive payouts when minimum technical performance levels are not achieved on a system-wide basis would encourage improved performance. After discussions with FAA on this issue, Agency officials informed us that FAA will modify the contract to state the maximum potential incentive value that may be earned by the contractor.

Enforcing Contract Clauses Could Have Improved Oversight and Limited Overpayments

During our review, we identified multiple contract provisions that FAA has not enforced. In addition to not collecting contractually required performance reports for years, FAA also did not effectively implement other clauses that could have avoided or limited overpayments resulting from design changes.

Specifically, FAA has not enforced a contract clause requiring that the ADS-B contractor separately track and bill the Agency for the ADS-B infrastructure that is paid through subscription fees. FAA's contract states that all capital assets acquired for the unique and specific requirements of ADS-B under subscription charges—such as radio stations, related infrastructure, and site preparation—should be tracked and billed separately at no additional cost or price increase.¹⁹ Although FAA exercised this clause in June 2010 to require the tracking and separate billing, the contractor has not complied. Moreover, FAA did not take action to enforce the requirement because at the time, FAA officials held the position that knowledge of the capital costs would not be relevant, since the Agency did not buy the ADS-B hardware. More recently, though, after discussions with us about the potential usefulness of the data, and its availability at no cost, FAA determined it would require the contractor to provide the data.

FAA's revision of its position makes sense because identifying historical pricing information for amounts billed for radio stations can provide information for deleting or adding radio stations and avoid overpaying when modifying the contract price in the future. Without this pricing information, FAA has placed itself in an unfavorable position to negotiate potential price reductions or increases. For example, with pricing information, FAA could have sought an equitable adjustment from the contractor when the contractor implemented design changes and delivered less infrastructure than originally priced. Although it chose not to do so, FAA could have claimed a decrease in the contract price (a deductive equitable adjustment) because the amount of work being performed

¹⁹ ADS-B contract, Section H.33, Tracking of Capital Assets

was different than what was priced, thereby creating a constructive change to the fixed price contract.

Throughout deployment, FAA accepted fewer radio stations than originally priced in the contractor's proposal. For example, the contractor made a design change at airport surface locations and eliminated about 70 stations, while substituting other equipment, due to interference with existing ASDE-X²⁰ surface surveillance systems. Yet, FAA did not seek a downward price adjustment. Further, since announcing the ADS-B ground infrastructure was complete in 2014, FAA has paid for nine additional radio stations. According to Agency officials, these stations enhanced or added coverage. Since FAA did not seek deductive adjustments when quantities dropped because ADS-B would have disrupted ASDE-X service, yet negotiated price increases as quantities rose to enhance ADS-B

service, we asked FAA whether it considered that it may be overpaying for ADS-B infrastructure. According to FAA officials, they pay for a service and the number of radio stations delivered was not consequential.

However, we found that the number of radio stations delivered is consequential, as is FAA's decision to not acquire contractually required pricing information and not pursue downward contract price adjustments. In the absence of overall contract pricing information, we were able to acquire cost and pricing information for the almost \$2 million FAA agreed to pay to add just one radio station in Frederick, MD. (See figure 3.) Based upon an arithmetic extrapolation, we estimate FAA pays just over \$133 million in questionable costs for other radio stations that were included in the contractor's price proposal that were

Figure 3. ADS-B Radio Tower and Ground Infrastructure, Frederick, MD



Source: OIG

²⁰ Airport Surface Detection Equipment – Model X (ASDE-X) is an FAA surveillance system that uses data from multiple sensors to allow air traffic controllers to track surface movement of aircraft and vehicles to help reduce runway incursions.

never delivered because the contractor used different locations for radio stations than planned.²¹

When we described our analysis to FAA officials, they stated that the costs used for the Frederick location may not be indicative of costs associated with other locations. However, since the Agency has no alternative price analysis for comparison, FAA has no basis for this conclusion. Further, according to FAA officials, our calculation should have accounted for costs of potential technical differences between radio stations. However, without the contractually-required pricing information FAA never collected, we were unable account for these differences.

Table 3 provides a summary of significant contract clauses that were not enforced or waived. FAA's decisions not to enforce its own contract provisions limited its ability to oversee performance and manage the contract effectively.

Table 3. Contract Clauses That Were Not Enforced and Allowances Exceeding Contract Terms

Contract Section 3: Performance	
<p>4.1.2.5.8 Performance Measure Reporting Requires that the contractor collect, analyze and report performance measures on a monthly basis via the Performance Measures Report, Contract Deliverable Item PM-5.</p>	<p>FAA did not begin collecting the required performance reports until August 2015, after we called FAA's attention to the deliverable. As a result FAA lacked detailed information about the system's performance for years.</p>
<p>4.1.2.5.10 Performance Control Board The Contractor shall submit a SBS Service Change Proposal (SSCP) CDRL PM-6 (format defined by Contractor) for any proposed change or modification in equipment, systems, service, and operations that interface with or otherwise impact the NAS. These changes can be as a result of value added proposals, equipment refresh/technical upgrade, cost savings proposals, operational improvements, etc. which result in improved savings, efficiency, and performance.</p>	<p>After the contractor informed FAA that they would deliver fewer radio stations, FAA did not require the contractor to deliver an SBS change proposal as required by the contract because this is a service contract and were more concerned about coverage than radio stations.</p>

²¹ Our estimate is conservative because it excludes any differences between the costs of full radio stations and the costs of substituted redundant radios at surface volumes due to ASDE-X interference issues.

Contract Section H: Special Contract Requirements

H.7 Incentive/Disincentives Regarding Contract Performance

The TPM calculations in H.7 do not hold the contractor accountable for planned outages such as equipment maintenance or equipment and software upgrades. However, Section 4 of the contract requires that performance must meet ADS-B critical specifications that require all outages be counted to compute availability.

The performance requirement for availability is ambiguous. The TPM language results in paying incentives in situations when the critical specification for availability is not met. The system-wide performance requirement is not being achieved, regardless of the contract provision utilized and the benefits of the incentive payments are unclear.

H.33 Tracking of Capital Assets. FAA exercised this clause that requires that the contractor track and separately bill the amounts associated with capital assets. However, the contractor is not complying and FAA has not enforced the requirement.

FAA does not have information associated with infrastructure costs that were undelivered, substituted, or added. As a result, FAA is unable to assess the reasonableness of amounts being paid. FAA has recently agreed to enforce that contract clause.

Source: OIG analysis.

FAA Missed Opportunities To Better Ensure a Reasonable Firm Fixed Price When Awarding the Contract

Using lessons learned from ADS-B, FAA can strengthen pre-award procedures to improve its acquisition of future systems that the Agency will not own. More specifically, we identified a number of areas where FAA missed opportunities to ensure price reasonableness and potentially obtain better prices, both prior to contract award and during the course of the contract.

FAA Did Not Take Steps To Identify the Infrastructure Quantities To Be Delivered

At contract award, FAA did not specify in the contract the infrastructure quantities to be deployed in each service volume. As a result, while the contract includes a pricing matrix stating prices for service in each service volume, FAA did not have the necessary information at its disposal to know whether the subscription prices were reasonable. This is in part because the contractor did not deliver a contractually required integrated master schedule for Segment 2.²² In our opinion,

²² An integrated master schedule (IMS) identifies all the elements associated with development, production, and delivery of the total product. While FAA did produce a complete IMS for Segment 1, the Agency was unable to produce one for Segment 2 and instead provided a spreadsheet which includes far less detailed information than included in Segment 1. FAA said after Segment 1, the Agency moved from tracking the IMS in Microsoft Project to tracking it in PDF because of difficulties with file size, manpower needed to continually update it, and increased efficiency.

had the integrated master schedule been provided for the fixed price portion of the contract, FAA officials would have known what equipment the contractor intended to install. Not knowing what the contractor intended to install, yet agreeing to pay a fixed price for this unknown from 2007 through 2025, shifted cost risk from the contractor to FAA. Nevertheless, FAA officials maintain because the contract is fixed price and performance-based, its interests are protected by the specific performance outcomes stated in the contract, and requiring the contractor to maintain a specific number of radio stations was unnecessary. However, in 2012, the FAA's contracting officer stated in a letter to the contractor that the Agency was concerned over the decreases in the numbers of radio stations being deployed. Moreover, in preparing for ISAT, FAA approved particular numbers of radio stations for each service volume, and approved payments as a proportion of how many radio stations were installed.

FAA Did Not Sufficiently Examine Key Differences Between Competitor Proposals

When awarding the contract, FAA evaluated the bottom line prices for three competitive proposals to conclude that the selected contractor's proposed price was reasonable. However, the three proposals varied significantly in approach—such as the number of radio stations and radio characteristics. For example, the successful contractor proposed 794 radio stations, while the closest competitors proposed hundreds of fewer stations.

According to FAA, the Agency held discussions with competitors prior to awarding the contract. These discussions were particularly important considering that the ground infrastructure to deliver the service FAA required was not yet developed, and would need to be installed under the ADS-B contract before the service could be delivered. Such discussions should have included, for example, the numbers of radio stations and types of radios needed and an opportunity for offerors to revise their price proposals based on these discussions. The Contract Pricing Reference Guides used by other Federal agencies state that when determining whether items being evaluated are sufficiently similar to allow for comparison and establishment of price reasonableness, the Government should consider the quantity and capabilities of each item and make adjustments as appropriate. To that end, according to FAA, the winning bidder's number of radio stations were independently assessed and technically evaluated to be appropriate for the design approach. Yet, in the contract files, we found no documentation summarizing discussions FAA held with the competitors. Without such adjustments, discussions, or best and final offers, the three proposals could not be effectively compared due to significant differences in technical approaches.

FAA Did Not Document a Detailed Quantitative Review in the Contract File

While FAA officials assert that the winning proposal was technically superior and presented the lowest technical risk, FAA's files lacked documentation to demonstrate that it completed a detailed quantitative and qualitative review evaluation of the contractor's proposed number of radio stations and infrastructure. In the absence of this documentation, we interviewed officials from two support contractors involved in the review of the proposals. According to the opinions of the support contractors, the number of radio stations proposed by the successful offeror was conservative, meaning the awardee may have proposed more radio stations than was likely needed.

Given the large disparity in the number of radio stations proposed by the winner compared to the competitors, a detailed review was needed to ensure that the number of radio stations and proposed price were reasonable. When we discussed this with FAA officials, they said they obtained an independent assessment of the number of radio stations proposed, which found the number of radio stations appropriate. However, the only documentation FAA was able to provide to us was a study by John Hopkins University and MITRE that evaluated the effectiveness of coverage at only three service volumes—not the total number of radio stations required.

FAA's Revised Lifecycle Cost Estimate Relied on the Contractor's Assumptions

FAA selected the successful vendor based on a technical and business analysis, with consideration of costs to arrive at a best value selection. To support and confirm this analysis, FAA's support contractor subsequently conducted a price evaluation as required. However, the support contractor's evaluation was based on the assumption that 794 full scale radio stations were needed—the number of stations specified in the successful bidder's proposal. AMS states that “an [independent cost estimate] must not be based on information furnished by any potential vendor that may be considered for award.” Using the successful bidder's assumption that 794 stations were needed calls into question the independence of the estimate.

FAA's Contract Approach Limited Opportunities To Adjust Prices

FAA's acquisition approach further limited its abilities to effectively evaluate price. FAA relied on a “Grand Design” acquisition approach for delivering the design, development, and implementation for ADS-B over an 18-year period, relying on one contract award action which was entirely priced at initial award. While FAA used a cost plus incentive fee approach for Segment 1, which focused on developing and installing the system at several key sites, FAA priced

Segment 2, which included all remaining sites, as primarily fixed price at the date of contract award.

Thus, the Agency could not use what it learned in the early developmental stages of Segment 1 to more accurately price the rest of the contract. For example, in May 2012 the contractor informed FAA that it could complete the system with far fewer radio stations than originally proposed. However, FAA had already established fixed prices for Segment 2 implementation at contract award, rather than incrementally when the effort would begin. FAA did not adjust prices for the unneeded radio stations during the fixed-price production phase (Segment 2) of the contract. As a result, FAA is paying for undelivered radio stations.

OMB's Capital Programming Guide states that for long-duration contracts that include significant development, it may be impossible to estimate the cost of performing the entire contract with sufficient accuracy to use a fixed price or structured incentive contract from day one.²³ Instead, OMB guidance recommends modular contracting, such as independent contractual increments for phases of an acquisition, including design, development, and implementation, which can be successively priced. While FAA agreed to a recent OIG audit recommendation to include guidance on the use of modular contracting in AMS,²⁴ FAA has not yet implemented our recommendation.

CONCLUSION

FAA expects ADS-B to become a key program for improving safety, capacity, and efficiency in the National Airspace System. To that end, it is important for FAA to ensure that ADS-B services meet contract and operational performance requirements. Additionally, since FAA is planning to pay the contractor an additional \$900 million in subscription charges for providing ADS-B services through 2025, it is imperative for FAA to establish more timely and effective incentive fees that encourage or promote superior contractor performance and take steps to enforce contract clauses to increase visibility into contract costs, prevent payments associated with undelivered services, and recover potential overpayments associated with design changes. Until then, FAA will not be able to ensure it is most effectively using the hundreds of millions of taxpayer dollars remaining to be invested in ADS-B.

²³ The OMB guidance states that it may be desirable to initiate the work with a small, short-duration contract, such as a cost plus fixed fee contract for early design, evolve to a cost plus award fee or cost plus incentive fee contract for later design and initial development, and then to an incentive fee or fixed price contract for the initial implementation and production, *once all development work is complete* (italics added for emphasis). The guidance further emphasizes that, for such contracts, it also may be desirable to negotiate an estimated price in increments. As work progresses, prices should be determined at appropriate points, as those costs become more predictable.

²⁴ *FAA Reforms Have Not Achieved Expected Cost, Efficiency, and Modernization Outcomes* (OIG Report Number AV-2016-015), January 15, 2016. OIG reports are available on our website at <http://www.oig.dot.gov/>.

RECOMMENDATIONS

To improve FAA's abilities to oversee ADS-B performance, manage the contract more effectively, and pursue cost savings where possible, we recommend that the Federal Aviation Administrator:

1. Require the contactor to report on all seven technical performance measures to provide FAA with the ability to determine whether all performance requirements are being met and contractually required products and services are being received.
2. To disclose the total cumulative costs for the contract, identify and report the potential range or maximum value of incentive fees payable under the contract, about \$78 million, when reporting to managers, Congress, and other stakeholders.
3. Modify the contract to clearly identify the differences between critical service specifications for ADS-B and the technical performance measures for ADS-B services that are used for computing incentive awards.
4. Conduct and document a review of incentive fee implementation to ensure that it motivates the contractor to exceed the contract specifications and also minimizes performance violations as stated in the H.7 clause. Consider adjustments to the incentive fee implementation as a result of the review.
5. Enforce the H.33 clause to reveal capital asset cost and gain necessary pricing information for use in negotiating additions and enhancements to the ADS-B contract as has occurred on at least nine occasions previously.
6. Conduct and document an analysis to determine whether or not duplicate subscription fee payments are being made due to radio stations that support multiple service volumes.
7. Strengthen future acquisitions by adding or modifying guidance to AMS to incorporate concepts from the OMB Capital Programming Guide on considering the use of successive or incrementally priced contract, orders, or contract line items when acquiring or developing systems spanning many years. This guidance may be incorporated into planned guidance regarding the use of modular contracting concepts.
8. Strengthen future acquisitions by expanding guidance in the AMS or the FAA Pricing Guide to: (1) better describe the process for (a) evaluating price reasonableness and (b) determining cost realism when evaluating proposals, to include a review of quantities and types of hardware proposed; and (2) include in existing oversight processes a check to ensure that independent

government cost estimates and life cycle cost estimates are not established based solely on the awardee's proposal.

9. Strengthen future acquisitions by requiring that contracting officers and specialists in the Surveillance Contracting Branch keep hard and/or electronic back-up copies of contract file information in the contract file; keep the contract up to date, including modifications or changes such as partial acceptance, methodology for partial acceptance, pricing matrix adjustments, and other agreements created by correspondence outside the contract; and ensure that in Agency computers, a complete and accurate record of all contract actions and supporting documentation is established and maintained in real time.

AGENCY COMMENTS AND OFFICE OF INSPECTOR GENERAL RESPONSE

We provided FAA with a draft of this report on June 26, 2017, and received the Agency's formal response on August 9, 2017, which is included as an appendix to this final report. FAA concurred with all nine of our recommendations and provided target completion dates for recommendations 1 through 8. Accordingly, we consider recommendations 1 through 8 resolved but open pending completion of planned actions.

Regarding recommendation 9 on retaining contract records, FAA stated that the Agency has taken steps to brief contracting officers and specialists and requested that we close the recommendation. However, the Agency's response also indicates that FAA will brief the surveillance acquisition team on this issue, and no target completion date was provided. Therefore, we are requesting FAA provide us with information on the acquisition briefing and a target action date to meet the intent of our recommendation. Until then, we consider recommendation 9 unresolved.

In its formal response, FAA also disagreed with a number of statements in this report, which we address as follows.

First, FAA disagreed with our conclusion that the Agency's monitoring does not ensure all seven ADS-B contractual performance-level requirements are being met. Rather, FAA stated the system is appropriately monitored. However, our conclusion is based on the language of the contract and reports produced by FAA's own independent monitoring system. As we stated in our report, the contract specifies that the contractor should assure FAA that the ADS-B system is meeting all seven performance level requirements, and FAA's independent monitoring system only reports on three of the seven. While FAA told us that the Agency used other means to monitor the performance requirements that were not reported, we found limitations in the other means used. In April 2017, at the

conclusion of this audit, FAA stated it is negotiating with the contractor to require reporting on all seven performance requirements.

Second, FAA disagreed with our statement that limitations in its implementation service acceptance testing (ISAT) raise a question of whether all requirements were met before ADS-B system acceptance. FAA asserts that its acceptance process was rigorous, and FAA identified additional test activities that it undertook in addition to acceptance testing. Our report acknowledges these other test activities. Nevertheless, as our report also states, these other tests were either conducted after ISAT acceptance or were conducted separately in a factory test environment.

Third, FAA disagreed with our conclusion that the Agency has reduced coverage and performance requirements in the contract. As our report states, despite the contract requirement (critical service specification) that all outages be included when measuring availability, FAA does not include scheduled outages when measuring system availability for paying incentives. Further, in discussions with FAA regarding the differences between measuring availability for the critical service requirements and for determining incentive fees, the Agency told us it intends to also modify the critical service requirements to exclude scheduled outages when measuring operational availability. As we interpret FAA's proposed action, it would reduce contractual performance requirements.

Fourth, FAA implied that our conclusions are flawed because we present ADS-B service performance statistics on a system-wide, rather than a single service volume basis. However, although we used system-wide performance statistics provided by FAA's own independent monitor, we also supported our conclusions on the outages that occurred at individual service volumes. While some facility outages had service restored in a few minutes, other outages took hours to have services restored at some facilities.

Fifth, FAA's response stated that we misinterpreted an ADS-B contract clause that discusses the ability of the agency to adjust payments based on changes in system infrastructure delivery, arguing this clause is not a price redetermination clause. We agree that this clause is not a price redetermination clause. Rather, as we state in our report, the clause establishes intent to assign the cost of a radio station to only one service volume and our report states this clearly.

Finally, FAA stated that it determined price reasonableness using a comparison of comparable services established at contract award based on "free market" competition. However, it is important to note that the ground infrastructure needed to deliver ADS-B services was not yet developed at contract award. Yet, FAA priced the entire 18-year contract at initial award. The competing proposals that

FAA references varied significantly in approach, such as the quantity of radio stations to be delivered and differences in radio characteristics proposed. As our report states, Government contract pricing guides recommend further price analysis in such situations to determine or establish price reasonableness. We were unable to find documentation to support that FAA conducted meaningful discussions or further analysis of the competing proposals with regard to price reasonableness.

ACTIONS REQUIRED

We consider recommendations 1 through 8 resolved but open pending completion of planned actions. We consider recommendation 9 open and unresolved and request that FAA provide a target action date, as detailed above, within 30 days of this report in accordance with DOT Order 8000.1C.

We appreciate the courtesies and cooperation of FAA representatives during this audit. If you have any questions concerning this report, please call me at (202) 366-1249 or Nathan Custer, Program Director, at (202) 366-5540.

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cc: The Secretary
FAA Deputy Administrator
FAA Chief of Staff
DOT Audit Liaison, M-1
FAA Audit Liaison, AAE-100

EXHIBIT A. SCOPE AND METHODOLOGY

We conducted this audit from October 2014 through June 2017 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.

The FAA Modernization and Reform Act of 2012 directed us to review FAA's award and oversight of any contracts entered into to provide ADS-B services for the national airspace system. Our audit objectives were to determine whether (1) the ADS-B contract provides FAA the ability to monitor whether the contractor is providing required ADS-B products and services; and (2) FAA's procedures are adequate for determining whether payments to the contractor are reasonable.

To address our first objective, we obtained and analyzed key documents on ADS-B contracting, system engineering, testing, and monitoring activities. We also interviewed key FAA ADS-B contracting and program officials at FAA Headquarters in Washington, DC; the FAA William J. Hughes Technical Center in Atlantic City, NJ; and FAA's Mike Monroney Aeronautical Center in Oklahoma City, OK. We also analyzed relevant Federal regulations and interviewed industry officials and other stakeholders. See exhibit B for a list of organizations visited or contacted. We coordinated with the OIG statistician to select a random sample of service volumes we used to evaluate contractor-performed tests to assess ADS-B performance measures. The measures included coverage, capacity, integrity, and availability. We used a stratified sample of 47 out of 311 service volumes. We stratified the sample based on deployment segment; types of airspace (en route, terminal, or surface); and, for terminal, classes of airspace (Class B, Class C, or Class D).

To address our second objective, the adequacy of FAA's procedures for determining the reasonableness of payments to the contractor, we reviewed the ADS-B contract, the Agency's incentive and disincentives agreement and payment amounts, monthly performance reports, invoices, cost reasonableness documents, life cycle cost estimates, site acceptance procedures, an ADS-B coverage report, and contract approach. We obtained and analyzed data used to monitor the ADS-B contract including data relating to contract costs and management, incentives, performance, and FAA's internal Performance Control Board (PCB) correspondence.

As part of our review of performance, we reviewed performance data submitted by the SBS Monitor and performance data collected by the contractor that was

reported by FAA. We found differences between the data as addressed in the report.

To obtain additional information on the ADS-B installation infrastructure, we visited and interviewed officials at the Frederick Municipal Airport, in Frederick, MD, where a site was added through contract modification. We interviewed key FAA and ADS-B program officials at FAA Headquarters in Washington, DC, and Oklahoma City, OK. We also met with industry officials. We interviewed FAA support contractors in Washington, DC, and Bedford, MA, to discuss pre-award contract activities and post-award contract actions.

During the course of the review we encountered delays receiving requested documents and found that some contract documentation, including pricing information and market research data, were not retained in the contract file or a network drive that FAA used to provide us with relevant information. Contracting officials stated that some data were missing due to a computer virus. In addition, due to communication challenges between FAA and OIG, which required high-level resolution, key contract correspondence and other data on system reliability and disincentive payments was not made available to us until after a first exit conference, forcing extension of the time spent drafting this report, and additional exit conferences.

EXHIBIT B. ORGANIZATIONS VISITED OR CONTACTED

Federal Aviation Administration (FAA)

Headquarters

Acquisitions and Contracting	Washington, DC
Surveillance & Broadcast Services Program Office	Washington, DC

Sites

FAA William J. Hughes Technical Center	Atlantic City, NJ
Mike Monroney Aeronautical Center	Oklahoma City, OK
Potomac Consolidated Terminal Radar Approach Control (TRACON)	Warrenton, VA
Will Rogers Airport, FAA Oklahoma City Tower	Oklahoma City, OK
Frederick Municipal Airport	Frederick, MD

Industry

The Boeing Company	Seattle, WA
Management Consulting and Research, Inc.	Bedford, MA
Regulus Group	Washington, DC

EXHIBIT C. MAJOR CONTRIBUTORS TO THIS REPORT

<u>Name</u>	<u>Title</u>
Mary Kay Langan-Feirson	Assistant Inspector General for Acquisition Audits
Nathan Custer	Program Director
Kevin Dorsey	Program Director
Terrence Letko	Acquisition Advisor
Arnett Sanders	Project Manager
Melissa Pyron	Senior Analyst
Won Kim	Senior Auditor
John Holmes	Senior Auditor
Zachary DesJardins	Analyst
Jonathon Nuckles	Analyst
Amy Berks	Legal Counsel
Audre Azuolas	Writer-Editor
Petra Swartzlander	Senior Statistician



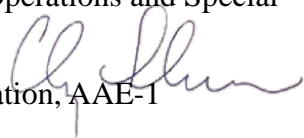
Federal Aviation Administration

Memorandum

Date: August 9, 2017

To: Mary Kay Langan-Feirson, Assistant Inspector General for Acquisition and Procurement

Charles A. Ward, Assistant Inspector General for Audit Operations and Special Reviews

From: H. Clayton Foushee, Director, Office of Audit and Evaluation, AAE-1 

Subject: Federal Aviation Administration's (FAA) Response to Office of Inspector General (OIG) Draft Report: Greater Adherence to ADS-B Contract Terms May Generate Better Performance and Cost Savings for FAA

The Automatic Dependent Surveillance-Broadcast (ADS-B) system was completed utilizing an innovative performance-based contract¹, and has completed the backbone of the Next Generation Air Transportation System (NextGen). The contractor-built and maintained ADS-B system is performing in a cost-effective manner compared to what would have been the long-term costs of a government-purchased, owned, maintained, and operated system. The OIG has not accurately reported on key elements of the ADS-B contract, the technical requirements, and processes. Accordingly, the FAA maintains that the OIG draft report draws flawed conclusions and is not a balanced presentation. Our specific concerns are listed below:

- The draft report asserts that the FAA does not perform adequate performance monitoring and states that four requirements are not being monitored (i.e., **coverage**, **capacity**, **integrity**, and **independent validation**). The Agency strongly disagrees with that assertion and maintains that all seven performance requirements are appropriately monitored. **Coverage** is validated through the design review process, with operational validation of ADS-B equipped aircraft, and during formal flight inspection. As we explained and documented to the OIG, **capacity** is directly correlated with other parameters monitored in real time and reported monthly. The FAA also explained and provided evidence that **integrity** is monitored through controlled inputs that are made available during the initial software and system qualification testing, and thereafter, through compliance monitoring of avionics fleet performance. The system contains multiple tools for real-time monitoring of

¹The ADS-B contract is a complex performance based contract which defines incentives and disincentives based upon specified technical performance measures. The contract is primarily comprised of firm fixed price for subscriptions for services under a performance based structure. The FAA used a cost plus incentive fee structure for the design and development.

test message performance and is continually monitored. **Independent validation** is monitored and reported through the monthly submissions of Technical Performance Measures Reports.

- We disagree that our acceptance testing process is limited. The FAA implemented and conducts rigorous testing processes to ensure that the requirements of the nation’s air transportation system are being met by the ADS-B system, but that fact is not reflected in the draft report. The Agency performs comprehensive flight tests, and every terminal and en-route Service Volume (SV is a contractually-defined volume of airspace requiring ADS-B services) underwent comprehensive flight inspections before commissioning. Flight inspections include: the controlled FAA flight inspection aircraft with certified avionics; the Surveillance and Broadcast Services Subsystem (SBSS) SV(s) under test; and the receiving facility automation system, as well as an observing air traffic controller. We provided the OIG with flight inspection reports containing the above information.
- Contrary to OIG statements, FAA never reduced coverage and performance requirements. The OIG is misinterpreting a contract clause regarding the allocation of the cost of radio sites that support more than one SV. As we explained to the OIG on numerous occasions, the FAA did not buy radios; it procured services within defined SV(s). The contract clause is not a price redetermination clause, but rather documents the assumptions underlying the contractor’s cost methodology. Although all SV coverage requirements have been met, the OIG incorrectly assumes that the FAA should get the benefit of lower costs because it incorrectly correlates the number of radios with the contractually-required volume of services. Moreover, conclusions drawn by the OIG based upon “system-wide” performance metrics are flawed because they are based upon a requirement that does not exist in the contract. Further, the OIG’s presentation of aggregate service availability obscures the service performance in most locations in the National Airspace System (NAS) each month, which could lead a reader to erroneously conclude that the service is unsuitable nationwide, when in fact, a service interruption at a single facility could have taken a few minutes to restore.
- The OIG cites that the Agency cannot determine whether equipment and installation prices are reasonable. The FAA determines the price reasonableness using a comparison of comparable services established at contract award, which was based upon free-market competition.

While the Agency agrees to consider the minor process enhancements the OIG recommends to the ADS-B contract, this in no way should be construed as agreement with what we consider to be the OIG’s erroneous conclusions. The FAA concurs with all 9 recommendations as written. We plan to implement recommendations 2 and 5 by October 31, 2017; recommendations 3 and 4 by December 31, 2017; recommendations 7 and 8 January 31, 2018; and recommendations 1 and 6 by April 30, 2018. Regarding recommendation 9, on June 30, 2017, the Agency briefed the contracting officers and specialists to ensure that contract documents are retained as accurately and as completely as possible. We request that this recommendation be closed.

We appreciate this opportunity to respond to the OIG draft report. Please contact H. Clayton Foushee at (202) 267-9000 if you have any questions or require additional information about these comments.

Appendix. Agency Comments