INTERNAL AUDIT DIVISION

REPORT 2016/040

Audit of the Aviation Information Management System in the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo

Overall results relating to the effective implementation of the Aviation Information Management System were initially assessed as unsatisfactory. Implementation of four critical and two important recommendations remains in progress

FINAL OVERALL RATING: UNSATISFACTORY

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CONTENTS

AUDIT REPORT

Audit of the Aviation Information Management System in the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo

I.   BACKGROUND

1.   The Office of Internal Oversight Services (OIOS) conducted an audit of the Aviation Information Management System (AIMS) in the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO).

2.   In accordance with its mandate, OIOS provides assurance and advice on the adequacy and effectiveness of the United Nations internal control system, the primary objectives of which are to ensure: (a) efficient and effective operations; (b) accurate financial and operational reporting; (c) safeguarding of assets; and (d) compliance with mandates, regulations and rules.

3.   Aviation support plays a critical role in peacekeeping operations. The Secretary-General's report A/65/738 characterized effective air support and air transportation services to peacekeeping missions and special political missions as a "key enabling factor in the achievement of Security Council mandated objectives in field missions". In the same report, the Secretary-General addressed the recommendation made by the Board of Auditors to strengthen the data monitoring system of air operations, stating that DFS had made it a priority to develop and implement an electronic air transport management system to facilitate the global management of air operations.

4.   The United Nations maintains a fleet of aircraft (both fixed wing and rotary wing) that are deployed to various peacekeeping and special political missions around the globe. These aircraft are provided by commercial operators and military units from a number of troop contributing countries through letters of assist. As of December 2013, the United Nations' fleet included 59 fixed wing and 144 helicopters (both military and civilian) across 16 peacekeeping operations and special political missions. The approved budget for air transportation in peacekeeping operations for 2014-2015 was $845 million.

5.   The Air Transport Section (ATS) of the Logistics Support Division (LSD) within the Department of Field Support (DFS) is responsible for the United Nations aviation programme. In delivering its mandate, ATS is responsible to coordinate with: (i) Aviation Sections in field missions; (ii) the Transportation and Movement Integrated Control Centre in the Regional Service Centre (RSCE) in Entebbe, Uganda; and (iii) the Strategic Air Operations Centre (SAOC) of the United Nations Global Service Centre (UNGSC) in Brindisi, Italy.

6.   Air assets for United Nations air operations were acquired on a mission-by-mission basis and were subject to the individual budgets approved for each mission in support of their respective mandates. After deployment, the concerned missions assumed responsibility for the utilization and safety of the aircraft. However, ATS was responsible for contract management and invoice payments to vendors for aircraft utilized in field missions, and also for reporting to the General Assembly on the utilization of air assets and performance of air operations across the United Nations Secretariat.

7.   MONUSCO was established by Security Council resolution 1925 of 28 May 2010. The current mandate of MONUSCO, as established by Security Council resolution 2211 of 26 March 2015, provides for an authorized troop strength of 19,815 military personnel, 760 military observers and staff officers, 391 police personnel, and 1,050 personnel of formed police units.

8.   MONUSCO had the largest air operations programme within the United Nations peacekeeping operations. The mission's Aviation Section located in Goma managed the operation of flights within MONUSCO. The approved resources for air transportation at MONUSCO for the period from 1 July 2014 to 30 June 2015 were $206.5 million. The air asset utilization rates (i.e., hours flown) for the same period were 16,623 hours for civilian aircraft and 12,757 hours for military aircraft.

9.   AIMS was the third information and communications technology (ICT) project aimed at addressing the needs for aviation information management. The first proposal to acquire a commercial off-the-shelf solution ended in 2010 without a satisfactory outcome. A second initiative was led by SAOC at UNGSC with the development of the Smart Fleet system. However, the system was discontinued prior to going live in April 2013 because it did not meet all the needs for aviation information management.

10.   In 2013, at the request of ATS, the Information and Communications Technology Division (ICTD) of DFS commenced the development of AIMS to cover the business needs of the three parties (i.e., ATS Headquarters, SOAC at UNGSC and the Aviation Sections in each field mission). ATS required from ICTD (the developer) a standard web-based system to: (i) support air operations, contract management and invoice processing; and (ii) provide real-time monitoring and analytics of the associated data.

11.   As of 30 November 2015, AIMS had been deployed in 12 of the 13 missions identified.

12.   AIMS is part of the Field Support Suite (FSS) which is a web-based unified suite of solutions developed by ICTD in accordance with the strategy to standardize all field applications. FSS is a shared technical platform that allows its modules to work together and simultaneously process consecutive and concurrent workflows involving multiple business sections.

13.   FSS was selected as the platform of choice because it already provided a suite of field applications sharing relevant data related to air operations, including movement of personnel, passenger booking and ticketing. AIMS was also expected to leverage the underlying security, disaster recovery and support of FSS.

14.   Comments provided by DFS are incorporated in italics.

II.   OBJECTIVE AND SCOPE

15.   The audit was conducted to assess the adequacy and effectiveness of governance, risk management and control processes established by DFS and MONUSCO in providing reasonable assurance regarding the **effective implementation of AIMS in MONUSCO.**

16.   This audit was included in the 2015 work plan of OIOS due to the high risks associated with air operations, including aviation information management, which play a critical role in peacekeeping operations. MONUSCO was selected for the audit because it manages the largest air operations and was one of the three pilot missions that began using AIMS from 1 November 2014.

17.   The key controls tested for the audit were: (a) project management; and (b) ICT support systems. For the purpose of this audit, OIOS defined these key controls as follows:

(a)   **Project management** - controls that provide reasonable assurance that the AIMS project was managed and implemented efficiently and effectively; and

(b)   **ICT support systems** - controls that provide reasonable assurance that AIMS enables the management of air operations in MONUSCO securely, efficiently and effectively in accordance with the requirements of the business users.

18.   The key controls were assessed for the control objectives shown in Table 1.

19.   OIOS conducted the audit from August to December 2015. The audit covered the period from January 2013 to November 2015.

20.   OIOS conducted an activity-level risk assessment to identify and assess specific risk exposures, and to confirm the relevance of the selected key controls in mitigating associated risks. Through interviews, analytical reviews and tests of controls, OIOS assessed the existence and adequacy of internal controls and conducted necessary tests to determine their effectiveness.

III.   AUDIT RESULTS

21.   The DFS and MONUSCO governance, risk management and control processes examined were initially assessed as **unsatisfactory**[1] in providing reasonable assurance regarding the **effective implementation of AIMS in MONUSCO**. OIOS made eight recommendations to address issues identified in this audit.

22.   DFS and MONUSCO had established some good control practices for the implementation and use of AIMS, such as: (i) building AIMS on the existing FSS platform, thereby leveraging the underlying security, disaster recovery and support controls; (ii) designing pre-defined reports; (iii) using a robust disaster recovery infrastructure; and (iv) performing a vulnerability assessment of the application. However, there were some critical control weaknesses due to: (i) inadequate project management and planning; (ii) weak system implementation procedures; (iii) inadequate system design; and (iv) weak data security and logging. Additional control weaknesses were identified in the system development life cycle and user requirements definition, reporting, business continuity and disaster recovery procedures, and service and change management.

23.   The initial overall rating was based on the assessment of key controls presented in Table 1 below. The final overall rating is **unsatisfactory** as implementation of four critical and two important recommendations remains in progress. DFS has not accepted two important recommendations. OIOS has closed these two recommendations indicating management's acceptance of residual risks arising from not implementing them and may be reported to the General Assembly accordingly.

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[1] A rating of **"unsatisfactory"** means that one or more critical and/or pervasive deficiencies exist in governance, risk management or control processes, such that reasonable assurance cannot be provided with regard to the achievement of control and/or business objectives under review.

Table 1: Assessment of key controls

Business objective	Key controls	Control objectives			
		Efficient and effective operations	Accurate financial and operational reporting	Safeguarding of assets	Compliance with mandates, regulations and rules
Effective implementation of AIMS in MONUSCO	(a) Project management	Unsatisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory
	(b) ICT support systems	Unsatisfactory	Unsatisfactory	Unsatisfactory	Partially satisfactory
FINAL OVERALL RATING: UNSATISFACTORY					

A.   Project management

Need to strengthen controls over project management and project planning

24.   ICT projects at the United Nations Secretariat are regulated by the administrative instruction on ICT initiatives (ST/AI/2005/10) and a project management framework based on the best practices defined in the "Projects in Controlled Environments, Version 2" (PRINCE2) methodology. In accordance with this framework, ICT projects should be supported by a business case based on defined standards and approved by an established ICT Committee.

25.   The AIMS project team had documented a project initiation document, which in its details envisioned the establishment of processes related to project governance. However, the project was not adequately supported by the controls prescribed by the United Nations ICT project management framework and PRINCE2. In particular, the following control weaknesses were noted:

(i)   The Project Board of AIMS did not operate as expected. Stakeholders were inadequately represented;

(ii)   The project initiation document prepared for AIMS did not adequately define and capture critical details related to project plan and costs, business case, project dependencies, infrastructure enhancements, project monitoring, and total cost of ownership;

(iii)   The project initiation document was not submitted to the Office of Information and Communications Technology for assessment and review;

(iv)   Project funding was not defined;

(v)   Risk management mechanisms were not implemented; and

(vi)   After the Headquarters Committee for Contracts (HCC) rejected the business case to procure an off-the-shelf product, DFS did not revise the AIMS business case and made an internal decision to build the solution in-house without review and approval by its Information Management Committee.

26.   This condition was due to inadequate oversight and governance of AIMS, which may prevent the Organization from meeting its goal to implement an effective and efficient air transport information management system.

27.   PRINCE2 recommends the preparation of a project plan detailing the expected products, activities and resources of the project. The plan should also identify project stages and main control points to be used by the Project Board as a baseline against which to monitor the project's progress and costs.

28.   A detailed project plan for AIMS was not documented. Therefore, there was inadequate visibility over timelines, milestones, deliverables, sequence of processes, resource projections and project dependencies (i.e., interface with the Geographical Information System and the Organization's enterprise resource planning system - Umoja).

29.   Although, as of 30 November 2015, AIMS had been deployed in 12 of the 13 missions originally identified, the following critical functionalities were not sufficiently deployed:

(i) Aircrew management;

(ii) Invoicing module. Given that this module was not operational in ATS, the key benefit of enabling streamlined processing of invoices for aviation services through real-time access to information was not yet realized; and

(iii) Operations module. Given that this module was not fully functional in MONUSCO, it led to duplication of efforts and the need for manual intervention.

30.   In addition, the availability of AIMS as a tool to analyze performance and substantially reduce the workload associated with manual verification was still a work in progress.

31.   These conditions were due to inadequate project planning and monitoring mechanisms which resulted in weaknesses in project management and non-achievement of the benefits expected from implementing AIMS.

> **(1)   DFS should comply with the requirements of the United Nations ICT project management framework by: (i) reconstituting the Project Board of the Aviation Information Management System to direct and monitor the implementation timelines for critical system functionalities in all missions; (ii) documenting a project plan; (iii) updating the high level business case; (iv) defining a budget for the project; and (v) monitoring and documenting project costs.**
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> *DFS accepted recommendation 1 and stated that: (i) it was in the process of establishing a Project Board; (ii) it had put in place a project plan; (iii) it will update the high level business case;(iv) the budget will be defined once the Project Board has been established; and (v) project costs were recorded and the business owner will monitor them once the project board is established. OIOS reviewed the updated project plan provided by DFS and noted that it did not provide a breakdown of tasks, deliverables (i.e., additional modules) and timelines associated with the project and the extended implementation phase described in the plan. Recommendation 1 remains open pending receipt of evidence demonstrating that: (i) the Project board is established; (ii) the project plan is updated to include a breakdown of phases, deliverables and timelines; (iii) the high level business case is updated; (iv) the project budget is defined; and (v) project costs are adequately recorded and monitored*

Need to strengthen the system development life cycle and complete the definition of user requirements

32.   A system development life cycle is a methodology comprising a number of distinct work phases, which are used by systems developers to plan, design, build, test, and deliver information systems that

meet customer requirements. This methodology should have supported the development of AIMS with clearly defined phases, milestones, and cost estimates.

33.   The project initiation document of AIMS stated that the development of the system would follow a cascaded structure (i.e., "Waterfall") with the following phases: (i) initiation; (ii) analysis of requirements; (iii) design; (iv) build; (v) test; and (vi) deployment. The project initiation document further stated that during the build phase, an iterative approach (i.e., "Agile") would be followed for the delivery and build of the system with three iterations of development, quality assurance and user acceptance. In this regard, OIOS observed the following weaknesses:

> (i) There was no documented procedure to ensure the effective integration of the two software development approaches (i.e., "Waterfall" and "Agile") for developing AIMS. Therefore, the development phases were not clearly defined and tracked.

> (ii) The AIMS project did not adhere to the broad requirements of either software development approach because there was no formal review process of the project's critical phases.

> (iii) Several key project elements of AIMS had not been adequately considered, including the project size, complexity, user availability, and the level of integration with external systems.

> (iv) Given the absence of an established user group, missions indicated that the design of AIMS did not provide the essential functionalities needed to ensure the effective and efficient management of air operations.

34.   This condition was due to inadequate consideration of the size and complexity of the project, as well as the corresponding identification of the resources and tools required to ensure adequate implementation of AIMS. Consequently, the objectives of AIMS were not achieved.

35.   ICT professional best practices (i.e., Control Objectives for Information and Related Technology, COBIT) recommend the development of user requirements with documented, actionable, measurable, testable, traceable and detailed definitions.

36.   The Project Board of AIMS published and approved a functional requirement document with a data model diagram, indicating that user representatives would be engaged with the project management and development teams to: (i) document requirements; (ii) validate wire frames mock-up (used to simulate screens of the software system); and (iii) conduct user acceptance tests.

37.   DFS did not adequately define and capture its requirements because representatives of field missions had not been adequately involved during the planning phase. The developer stated that regular design sessions were held with one ATS staff in New York.

38.   Some use cases[2] (developed to identify, clarify, and organize system requirements) and wire frames[3] were documented, and the physical organization of data was defined in a data module diagram. However, these documents were not complete and did not adequately capture, clarify and organize the functional requirements into a complete design of the system. In addition, use cases were only documented for the contracts and invoice modules. There were no use cases for the operations module.

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[2] A use case is a list of actions and steps that define the interactions between a role (actor) and a system, to achieve a goal.
[3] A wireframe is a visual guide that represents the structure of a screen design.

39.   Furthermore, functional requirements were not translated into a technical design document for their implementation (i.e., procedures, data files, screens, interfaces, calculations and formulae, report specifications and frequency, and system response times and connectivity requirements). There were no baseline requirements to compare and measure users' requirements against AIMS performance and availability.

40.   As a result of inadequate gathering of requirements from the missions, MONUSCO:

(i)   Used AIMS as a data repository rather than a planning tool (i.e., for flight scheduling and operations). Flight schedules were manually prepared and validated using Microsoft Word/Excel and then recorded into the daily flight schedules post-facto for aircraft utilization reporting and scheduling;

(ii)   Was unable to use AIMS to compare planned and actual operations because data was not reliable; and

(iii)   Had to manually enter reporting data into AIMS and ATS databases. In addition, reports on aircraft utilization were transmitted to Headquarters using spreadsheets on a monthly basis for verification against invoices and contractual obligations.

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(2)   DFS should ensure that: (i) the system development life cycle of the Aviation Information Management System is commensurate with the complexity of the project and its size; (ii) requirements are gathered from all users and translated in technical design documents; and (iii) requirements are compared and measured against a reference baseline.

DFS did not accept recommendation 2 stating that: (i) it had selected the Waterfall model, with a three-phase delivery due to the complexity and size of the project; (ii) the requirements for future modules of AIMS were gathered from MONUSCO, the United Nations Mission in South Sudan and SAOC during a workshop held in Brindisi from 23 November to 11 December 2015; and (iii) a project baseline has been set, with agreed user acceptance criteria, in the requirements stage. OIOS reviewed the updated plan provided by DFS and noted that: (i) the plan was a summary timeline of the Waterfall methodology attributes but did not contain any detailed deliverable associated with functional or technical requirements; (ii) the timeline of these attributes mostly ended in 2013; (iii) the plan was not updated to reflect the additional development, implementation and deployment work scheduled after 2013, other than a task described as "extended implementation" ending in December 2015; (iv) the plan did not provide a breakdown of activities conducted during the extended implementation phase which covered a period of 23 months; and (v) the requirement definition activity conducted by DFS between November and December 2015 (and other planned project activities) were not explained and included in the updated plan. In addition, DFS did not provide evidence of the requirements gathering activity, the project baseline, and the user acceptance criteria. This unaccepted recommendation has been closed and may be reported to the General Assembly indicating management's acceptance of residual risks.

Need to strengthen system implementation procedures

41.   ICT best practices (i.e., COBIT) recommend the formulation of a plan defining the strategy, sequence of steps, resource requirements, interdependencies, criteria for management agreement, installation requirements and a transition strategy for the implementation of ICT systems.

42.   ICTD had documented an implementation road map that provided a partial schedule of activities and procedures for uploading flight data. However, this roadmap did not contain an adequate outline of the major tasks of the deployment phase with details about how the system would be deployed, installed

and transitioned into operation across all peacekeeping missions (i.e., guidance for data conversion, testing, training, and manuals). In particular, the following were noted:

(i) A data conversion plan was not documented and procedures for converting data were not adequately defined to ensure correct data validation and data cleansing. This condition caused data in AIMS to be duplicated, incomplete, incorrect, and improperly formatted (e.g., duplicated airfield locations, missing call signs and duplicated call signs);

(ii) Although some use test cases were documented for user acceptance testing, they did not adequately reflect the details included in the functional requirement documents. In addition, testing was not sufficiently planned, performed and documented. Examples of weaknesses identified with testing included test data found in production data and no criteria documented for failed test, rework and retests; and

(iii) Implementation weaknesses were identified with regard to training, user manuals and interfaces with other systems, as follows:

(a) MONUSCO users explained that although some training had been provided on AIMS, the training provided on the use of Business Objects to extract reports had been very limited. In addition, training materials were not provided for reference once training was completed for both AIMS and Business Objects;

(b) User manuals were prepared. However, these manuals had not been periodically updated to reflect design changes made to reflect new AIMS functionalities; and

(c) Interface and integration requirements were not adequately assessed to identify the impact on existing applications and infrastructure during the requirement-gathering phase and the solution design phase to ensure that appropriate integration approaches were used. This condition caused implementation delays. For instance, the Umoja interface was still pending user validation while regression testing of the interface was completed in September 2014. In addition, the interface with the maps of the geographical information system that provided a graphical display of routes was not operational due to its impact on the system performance of AIMS.

43. This condition was due to the lack of adequate plans which resulted in delays in implementing the system and posed data reliability concerns.

> **(3) DFS should: (i) document a data conversion plan to prepare, cleanse and convert data from all sources; (ii) conduct test cases covering all key functionalities; (iii) undertake an assessment of the interface and integration requirements; and (iv) update the training strategy and user manuals.**
>
> *DFS accepted recommendation 3 and stated that: (i) data preparation, cleansing and conversion are part of the implementation activities; (ii) it had conducted test cases covering all key functionalities; (iii) it will undertake the assessment of the interface and integration requirements to ensure that an appropriate approach is adopted; and (iv) it has updated the training modules. Furthermore, DFS has implemented the process for reviewing and updating the AIMS user guides and manuals via the systems and project change request process. Future change requests that may impact the manuals are flagged in the application lifecycle management for action. OIOS reviewed the documentation provided by DFS regarding testing, training and user manuals, and noted that: (i) DFS did not provide evidence of the*

implementation of structured mechanisms for testing all key functionalities. In particular, no evidence was provided for test cases associated with the reporting functionalities; and (ii) DFS submitted snapshots of some training activities but did not provide evidence of a training strategy that will ensure adequate training of all key users. Therefore, OIOS reiterates its recommendation that DFS develop an action plan to address this situation satisfactorily. Recommendation 3 remains open pending receipt of evidence demonstrating the completion of: (i) a data conversion plan to prepare, cleanse and convert data from all sources; (ii) test cases covering all key functionalities; (iii) the assessment of the interface and integration requirements; and (iv) the training strategy.

B. ICT support systems

<u>Need to strengthen controls over system design</u>

44.   ICT best practices (i.e., COBIT) recommend to design systems with applications controls (i.e., authorization, input, processing and output) to ensure accuracy, completeness, timeliness, availability, and auditability of data.

45.   The complexity of AIMS should have been supported by documented functional and technical control designs for data input, processing, and output.

46.   AIMS was developed based on requirements defined in four documents: (i) functional requirements document; (ii) use cases; (iii) wireframes; and (iii) data model diagram. However, these documents were not based on a detailed risk and needs assessment.

47.   The following control weaknesses were observed which prevented the application from meeting user requirements and ensuring data integrity:

(i)   Manual controls were needed to compensate for the inadequacy of automated controls (i.e., manual validation checks of planning and reporting data);

(ii)   There was duplication of effort with the input of the same data in multiple databases and manual verification of their source by multiple staff members (i.e., ATS database and eMARS);

(iii) Some critical fields were either undefined (i.e., "start fuel" and "end fuel" data) or not considered mandatory (i.e., call signs and aircraft base location), causing errors in the computation of critical information;

(iv) The source of some data input was inconsistent. Some airfields in MONUSCO captured data about flight operations using radio logs from the "flight following unit", while others used the "aircraft use reports" provided by pilots;

(v)   There were data errors caused by manual input. For example, the system did not automatically calculate the difference in time between the point of origin and destination. Also, the "block start" and "end start" were manually calculated. These manual inputs were prone to input error;

(vi) There were insufficient data input checks to validate or reject inconsistencies in data entries. DFS transaction identification fields contained data with incorrect character and missing data. For instance, the "ETD LOCAL" field contained date entries described as 00/00/0000 and the "ETAUTC" field contained date entries described as 02/01/1900;

(vii) MONUSCO could not capture military reconnaissance flights with multiple legs that did not "shut down". The mission was unable to input the individual legs related to these operations and used a work around to capture start and end destination as being the same. Therefore, all other data related to the flight - which varied by each leg - could not be captured. This condition created "time overlap errors" and affected the aircraft utilization rates which were a key performance indicator for the mission; and

(viii) The weekly flight schedule sub-module was locked in pending validation mode. While new routes could be added, it was not possible to edit or remove old and incorrect ones. MONUSCO stated that the AIMS module was more a burden than a help and, therefore, decided not to use it because the systems automatically populated the daily flight schedules with incorrect flights.

48.   Processing controls were not adequately defined (i.e., processing steps, including specification of transaction types and processing rules) and implemented in AIMS, which negatively affected data integrity with missing transactions and errors. The following weaknesses were noted:

(i)   There was inadequate control over changes made to processed (i.e., validated) transactions. For instance, recorded air operation transactions could be modified or deleted by any user with access to the operations module without independent review and logging of the changes;

(ii)   The system generated unique transaction identifiers for transactions completed in the flight operations module. However, the field that captured this data was editable. In addition, unexplained null values and gaps in the sequence of the ID numbers were identified;

(iii)   There were several instances where processed data was incomplete. Data was either not transferred or transferred incorrectly (i.e., missing legs and empty fields in the validate change screen). There were also transactions that generated errors due to incomplete or incorrect data (i.e., missing call signs, same aircraft with different contract numbers);

(iv)   MONUSCO compared the data in the legacy ATS database with the eMARS report generated from AIMS. A comparison of data in both systems identified data discrepancies;

(v)   The ownership and control of master data was not defined causing inadequate control over the update and creation of master data (e.g., air field locations);

(vi)   There were delays in the input of critical master data (i.e., contract master data by ATS) which prevented the scheduling and reporting of aircraft utilization data in AIMS. There were errors in reporting and discrepancies between the legacy ATS database and AIMS eMARS report (e.g. two aircraft, UNO816 and UNO817, which were operating under contract LOA-2013-076, were tasked but were missing from ATS and eMARS); and

(vii)   There was no process for the regular review of system tables and parameter files to confirm the accuracy of data processed and stored in AIMS e.g., master data associated with airfield locations, contracts, mission call signs.

49.   This condition was due to the absence of a detailed risk assessment that defined the requirements for ensuring the accuracy, completeness, timeliness, availability and auditability of data in AIMS.

(4)   DFS should reassess the system design based on the weaknesses identified in the Aviation Information Management System and implement additional control mechanisms to: (i) correct

manual and duplicate data input processes; (ii) address data inconsistencies and critical data; (iii) review fields defined as optional and editable; (iv) review data deletion and change mechanisms; and (v) correct duplicated transactions.

DFS accepted recommendation 4 and stated that it will assess the interface and integration requirements to ensure that an appropriate approach is adopted to address the recommendation, and present it to the Project Board once it is established. Recommendation 4 remains open pending receipt of evidence supporting the reassessment of the system design to: (i) correct manual and duplicate data input processes; (ii) address data inconsistencies and verify critical data; (iii) review fields defined as optional and editable; (iv) review data deletion and change mechanisms; and (v) correct duplicated transactions.

Need to strengthen reporting requirements and procedures

50.   The Secretary-General reported in document A/68/731 that AIMS would capture a high volume of data to establish a baseline for benchmarks and key performance indicators. It was expected that the analysis of these indicators would support safety oversight, aircraft usage optimization, fleet composition, forecasting, definition of procurement needs, and monitoring of contract performance and compliance.

51.   Although some predefined reports had been designed in AIMS, there was no evidence that DFS had determined its reporting requirements. In addition, the following control weaknesses were identified with regard to reporting:

(i)   DFS did not define the responsibilities for the review, detection, and analysis of error handling and exceptions.

(ii)   The business intelligence software (Business Objects) being used in conjunction with AIMS to facilitate the reporting process of air operations was not adequately configured (i.e., the software did not provide visibility of the field containing transaction identification codes).

(iii)   It took MONUSCO 24 hours to generate reports because the datamart replication was processed only once a day. Delays in replication of data impacted the reliability of reports.

(i)   There were no defined procedures for developing new reports (i.e., new reports to distinguish "revenue" and "non-revenue" generating flight transactions).

(ii)   There were significant inconsistencies between the reports generated with the business intelligence software and the data stored in AIMS. For instance, Business Objects reports showed that an aircraft with an expired contract was tasked in July 2015. However, in AIMS, the aircraft still had a valid contract.

52.   This condition was caused by an inadequate analysis of reporting requirements.

(5)   DFS should define its reporting requirements for the Aviation Information Management System (AIMS) by: (i) specifying responsibilities for the review, detection, and analysis of errors and exceptions; (ii) configuring the Business Objects software; (iii) defining procedures for developing new reports; and (iv) providing training to users on how to extract reports from AIMS using Business Objects.

DFS accepted recommendation 5 and stated that it will define its reporting requirements once the Project Board has been established. Recommendation 5 remains open pending receipt of evidence

demonstrating that reporting requirements have been defined for AIMS by**:** (i) specifying responsibilities for the review, detection, and analysis of errors and exceptions; (ii) configuring the Business Objects software; (iii) defining procedures for developing new reports; and (iv) providing training to users on how to extract reports from AIMS using Business Objects.

Need to strengthen data security and system logging

53.   The United Nations project management framework included the requirement to define information security controls into the design of any system. These controls pertained to confidentiality, integrity, availability, auditability and accessibility of data.

54.   DFS issued user access procedures for the FSS suite of applications, and a user access matrix for AIMS. However, the following control weaknesses were noted with regard to AIMS data:

(i)   Access procedures were not specifically defined for AIMS. The FSS access procedures were not aligned to the documented AIMS user access matrix of roles and responsibilities to ensure adequate separation of duties between potential conflicting functions;

(ii)   The AIMS user access matrix did not adequately separate conflicting roles because: (a) flight planners had the ability to access and delete executed plans in the flight operations mode; and (b) contract details were recorded and approved by the same person; and

(iii)   There were no password controls to ensure adequate user authentication and integrity of data. AIMS did not request users to change their generic password during their first access of the system. In addition, military personnel were allocated generic passwords to perform their duties in AIMS and in some instances, they shared the user identities and passwords of other MONUSCO staff.

55.   This condition was due to the lack of an adequate information security risk assessment, which could weaken the integrity of data within AIMS.

56.   The international ICT security management standard adopted by the United Nations Secretariat (ISO/IEC 27001) recommends the safekeeping of event logs recording critical activities (i.e., user activities, exceptions, faults and information security events).

57.   Deletion and modification of aviation transactions were considered critical activities. However, the log of AIMS did not record critical data changing activities (i.e., edit, modify and delete flight transactions) performed by users with access to the operations module of the system. Furthermore, AIMS was not configured to capture the audit trail of complete transactions (i.e., from input to output).

58.   This condition was due to the lack of detailed user requirements for capturing relevant event logs, which may prevent the Organization from investigating cases of misuse of AIMS.

(6)   DFS should: (i) define an access control procedure for the Aviation Information Management System; (ii) review the assignment of user roles; (iii) automate the segregation of potentially conflicting duties; (iv) implement adequate password controls; and (v) log critical processing activities (i.e., edit, modify and delete flight transactions).

DFS accepted recommendation 6. Recommendation 6 remains open pending receipt of evidence demonstrating the completion of the: (i) access control procedure for AIMS; (ii) review of assigned user roles; (iii) the segregation of potentially conflicting duties; (iv) implementation of adequate password

controls; and (v) logging of critical processing activities (i.e., edit, modify and delete flight transactions).

Need to strengthen business continuity and disaster recovery procedures

59.   ICT best practices (i.e., COBIT) recommend the development of detailed business continuity and disaster recovery procedures for any application deployed in the organization.

60.   DFS had not defined its business continuity and disaster recovery requirements for AIMS (i.e. recovery time objective and recovery point objective).

61.   UNGSC stated that specific disaster recovery procedures for AIMS had not been developed. There were, instead, only generic disaster recovery procedures for the FSS suite, of which AIMS was one of the various applications. These procedures, however, did not define the recovery time and point objectives for FSS because it contained different applications with different operational priorities and risks.

62.   The lack of business impact assessment and disaster recovery procedures may result in data losses.

(7)   DFS should undertake a business impact assessment of the Field Support Suite and document business continuity and disaster recovery procedures in accordance with the recovery prioritization requirements of the entire suite.

DFS accepted recommendation 7 and stated that it has launched an initiative in 2015 to develop a business continuity plan for the Service for Geospatial, Information and Telecommunication Technologies. A business process map has been created (providing the list of all services) and the project is currently in the business impact analysis (BIA) phase. In the interim, DFS has been engaged on: (i) performing a number of failover exercises, including those for FSS applications; and (ii) reviewing the Information Technology Disaster Recovery Plan (DRP), including the risk assessment. Focus will be placed on performing the BIA of critical applications, including FSS applications. The current DRP includes BIA of the global FSS, but does not split FSS per individual application. As a result of the BIA and risk assessment, DFS will ensure that the recovery time objectives and the recovery point objectives of FSS are based on a risk assessment that determined the business criticality of the individual applications within the suite. Recommendation 7 remains open pending receipt of evidence demonstrating the completion of the business impact assessment, business continuity and disaster recovery procedures of FSS, in accordance with the recovery prioritization requirements of the entire suite.

Need to strengthen service and change management procedures

63.   ICT best practices (i.e., COBIT) recommend documenting procedures for managing service and change requests in a standard manner (i.e., all service requests and changes to applications, procedures, processes, system and service parameters, including maintenance and patches). The procedures should also include monitoring and escalation processes based on agreed-upon service level agreements (SLA) for the classification and prioritization of any reported issue (i.e., incidents, service requests or change requests).

64.   MONUSCO deployed the service management system "iNeed" and established procedures requiring service requests to be first reviewed at the mission level and then escalated to UNGSC. However, the following control weaknesses were identified with regard to AIMS changes and service requests:

(i)   There was a generic SLA for the FSS suite of applications. This SLA did not provide adequate coverage of AIMS-related issues regarding performance and reliability. For example, there were network connectivity issues in MONUSCO (downtime in the Kalemi Office) and application performance issues in Brindisi and Goma, which resulted in delays and downtime in AIMS processing. However, the system performance reports generated by UNGSC in Brindisi reflected only performance issues with the generic FSS suite and did not indicate the specific applications affected (i.e., AIMS). Therefore, system performance issues related to AIMS could not be effectively monitored and managed.

(ii)   There was no alignment between: (a) the documentation of AIMS issues logged by the global service desk; (b) the change requests made by MONUSCO; and (c) the AIMS change request log maintained by the project manager. This indicated that change requests bypassed established procedures through iNeed.

(iii) Change management standard operating procedures were in draft version and applicable to major and minor system enhancements.

(iv) Change requests were being used to manage new functional requirements which did not include a detailed analysis to justify the cost and benefit of additional enhancements.

(v)   There were no control mechanisms in place for tracking changes to AIMS.

(vi)   The AIMS change request log had not been updated since 2013.

65.   This condition was caused by the absence of: an adequate SLA for AIMS; and change management procedures. This may cause service delays, data loss, unreliable information and unauthorized changes.

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(8)   DFS should: (i) implement mechanisms to ensure that performance issues related to the Aviation Information Management System (AIMS) can be identified and resolved in a timely manner; (ii) comply with current procedures for service management using iNeed; and (iii) track and monitor the status of all change requests related to AIMS.

DFS did not accept recommendation 8 stating that it is: (i) monitoring performance issues in the same manner it monitors all other enterprise systems hosted in UNGSC; and (ii) in compliance with the established service management procedure. iNeed is used to log all issues and change requests, except during the project's early life support (ELS) phase. During ELS, issues were reported directly to the project manager in order to expedite issue resolution. A subsequent iNeed service ticket was created to log all the issues; and (iii) in compliance with the standard operating procedure for using the application lifecycle management to manage all FSS (including AIMS) change requests. Additionally, the forward schedule of changes is distributed to stakeholders via email on a weekly basis and published on the FSS login page. OIOS reviewed the information and documentation provided by DFS and noted that there was no evidence of: (i) the system performance reports of AIMS generated by UNGSC to measure its performance; and (ii) the complete logging of changes in iNeed. This unaccepted recommendation has been closed and may be reported to the General Assembly indicating management's acceptance of residual risks.

IV.   ACKNOWLEDGEMENT

66.   OIOS wishes to express its appreciation to the Management and staff of DFS and MONUSCO for the assistance and cooperation extended to the auditors during this assignment.

(*Signed*) Eleanor T. Burns
Director, Internal Audit Division
Office of Internal Oversight Services

STATUS OF AUDIT RECOMMENDATIONS

**Audit of the Aviation Information Management System in the
United Nations Organization Stabilization Mission in the Democratic Republic of the Congo**

Recom. no.	Recommendation	Critical[4]/ Important[5]	C/ O[6]	Actions needed to close recommendation	Implementation date[7]
1	DFS should comply with the requirements of the United Nations ICT project management framework by: (i) reconstituting the Project Board of the Aviation Information Management System to direct and monitor the implementation timelines for critical system functionalities in all missions; (ii) documenting a project plan; (iii) updating the high level business case; (iv) defining a budget for the project; and (v) monitoring and documenting project costs.	Critical	O	(i) Reconstitute the Project Board of the Aviation Information Management System to direct and monitor the implementation timelines for critical system functionalities in all missions; (ii) Document a project plan; (iii) Update the high level business case; (iv) Define a budget for the project; and (v) Monitor and document project costs.	Fourth quarter 2016
2	DFS should ensure that: (i) the system development life cycle of the Aviation Information Management System is commensurate with the complexity of the project and its size; (ii) requirements are gathered from all users and translated in technical design documents; and (iii) requirements are compared and measured against a reference baseline.	Important	C	This unaccepted recommendation has been closed and may be reported to the General Assembly indicating management's acceptance of residual risks.	Not provided
3	DFS should: (i) document a data conversion plan to prepare, cleanse and convert data from all sources; (ii) conduct test cases covering all key functionalities; (iii) undertake an assessment of the interface and integration requirements; and (iv) update the training strategy and user manuals.	Critical	O	(i) Document a data conversion plan to prepare, cleanse and convert data from all sources; (ii) Conduct test cases covering all key functionalities; (iii) Undertake an assessment of the interface and integration requirements; and (iv) Update the training strategy and user manuals.	Fourth quarter 2016

[4] Critical recommendations address critical and/or pervasive deficiencies in governance, risk management or control processes, such that reasonable assurance cannot be provided with regard to the achievement of control and/or business objectives under review.
[5] Important recommendations address important (but not critical or pervasive) deficiencies in governance, risk management or control processes, such that reasonable assurance may be at risk regarding the achievement of control and/or business objectives under review.
[6] C = closed, O = open
[7] Date provided by DFS in response to recommendations.

STATUS OF AUDIT RECOMMENDATIONS

Recom. no.	Recommendation	Critical[4]/ Important[5]	C/ O[6]	Actions needed to close recommendation	Implementation date[7]
4	DFS should reassess the system design based on the weaknesses identified in the Aviation Information Management System and implement additional control mechanisms to: (i) correct manual and duplicate data input processes; (ii) address data inconsistencies and critical data; (iii) review fields defined as optional and editable; (iv) review data deletion and change mechanisms; and (v) correct duplicated transactions.	Critical	O	(i) Correct manual and duplicate data input processes; (ii) Address data inconsistencies and critical data; (iii) Review fields defined as optional and editable; (iv) Review data deletion and change mechanisms; and (v) Correct duplicated transactions.	Fourth quarter 2016
5	DFS should define its reporting requirements for the Aviation Information Management System (AIMS) by: (i) specifying responsibilities for the review, detection, and analysis of errors and exceptions; (ii) configuring the Business Objects software; (iii) defining procedures for developing new reports; and (iv) providing training to users on how to extract reports from AIMS using Business Objects.	Important	O	(i) Specify responsibilities for the review, detection, and analysis of errors and exceptions; (ii) Configure the Business Objects software; (iii) Define procedures for developing new reports; and (iv) Provide training to users on how to extract reports from AIMS using Business Objects.	Fourth quarter 2016
6	DFS should: (i) define an access control procedure for the Aviation Information Management System; (ii) review the assignment of user roles; (iii) automate the segregation of potentially conflicting duties; (iv) implement adequate password controls; and (v) log critical processing activities (i.e., edit, modify and delete flight transactions).	Critical	O	(i) Define an access control procedure for the Aviation Information Management System; (ii) Review the assignment of user roles; (iii) Automate the segregation of potentially conflicting duties; (iv) Implement adequate password controls; and (v) Log critical processing activities (i.e., edit, modify and delete flight transactions).	Ongoing activity until project closure
7	DFS should undertake a business impact assessment of the Field Support Suite and document business continuity and disaster recovery procedures in accordance with the recovery prioritization requirements of the entire suite.	Important	O	Undertake a business impact assessment of the Field Support Suite and document business continuity and disaster recovery procedures.	First quarter of 2017
8	DFS should: (i) implement mechanisms to ensure that performance issues related to the Aviation Information Management System (AIMS) can be identified and resolved in a timely manner; (ii) comply with current procedures for service	Important	C	This unaccepted recommendation has been closed and may be reported to the General Assembly indicating management's acceptance of residual risks.	Not provided

STATUS OF AUDIT RECOMMENDATIONS

Recom. no.	Recommendation	Critical[4]/ Important[5]	C/ O[6]	Actions needed to close recommendation	Implementation date[7]
	management using iNeed; and (iii) track and monitor the status of all change requests related to AIMS.				

APPENDIX I

Management Response

Management Response

**Audit of the Aviation Information Management System in the
United Nations Organization Stabilization Mission in the Democratic Republic of the Congo**

Rec. no.	Recommendation	Critical[1]/ Important[2]	Accepted? (Yes/No)	Title of responsible individual	Implementation date	Client comments[3]
1	DFS should comply with the requirements of the United Nations ICT project management framework by: (i) reconstituting the Project Board of the Aviation Information Management System to direct and monitor the implementation timelines for critical system functionalities in all missions; (ii) documenting a project plan; (iii) updating the high level business case; (iv) defining a budget for the project; and (v) monitoring and documenting project costs.	Critical	Yes	Director LSD	Fourth quarter of 2016	DFS' comments are reflected in the report.
2	DFS should ensure that: (i) the system development life cycle of the Aviation Information Management System is commensurate with the complexity of the project and its size; (ii) requirements are gathered from all users and translated in technical design documents; and (iii) requirements are compared and measured against a reference baseline.	Important	No	NA	NA	DFS' comments are reflected in the report.
3	DFS should: (i) document a data conversion plan to prepare, cleanse and convert data from all sources; (ii) conduct test cases covering all key functionalities;	Critical	Yes	Director ICTD	Fourth quarter of 2016	DFS' comments are reflected in the report.

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[1] Critical recommendations address critical and/or pervasive deficiencies in governance, risk management or control processes, such that reasonable assurance cannot be provided with regard to the achievement of control and/or business objectives under review.

[2] Important recommendations address important (but not critical or pervasive) deficiencies in governance, risk management or control processes, such that reasonable assurance may be at risk regarding the achievement of control and/or business objectives under review.

[3] Please indicate feasibility and realistic timelines for implementation of the recommendation.

Management Response

**Audit of the Aviation Information Management System in the
United Nations Organization Stabilization Mission in the Democratic Republic of the Congo**

Rec. no.	Recommendation	Critical[1]/ Important[2]	Accepted? (Yes/No)	Title of responsible individual	Implementation date	Client comments[3]
	(iii) undertake an assessment of the interface and integration requirements; and (iv) update the training strategy and user manuals.					
4	DFS should reassess the system design based on the weaknesses identified in the Aviation Information Management System and implement additional control mechanisms to: (i) correct manual and duplicate data input processes; (ii) address data inconsistencies and critical data; (iii) review fields defined as optional and editable; (iv) review data deletion and change mechanisms; and (v) correct duplicated transactions.	Critical	Yes	Director LSD Supported by ICTD	Fourth quarter of 2016	DFS' comments are reflected in the report.
5	DFS should define its reporting requirements for the Aviation Information Management System (AIMS) by: (i) specifying responsibilities for the review, detection, and analysis of errors and exceptions; (ii) configuring the Business Objects software; (iii) defining procedures for developing new reports; and (iv) providing training to users on how to extract reports from AIMS using Business Objects.	Important	Yes	Director LSD	Fourth quarter of 2016	DFS' comments are reflected in the report.
6	DFS should: (i) define an access control procedure for the Aviation Information Management System; (ii) review the assignment of user roles; (iii) automate the segregation of potentially conflicting duties; (iv) implement adequate password	Critical	Yes	Director LSD Supported by ICTD	Ongoing activity till project closure	DFS' comments are reflected in the report.

Management Response

**Audit of the Aviation Information Management System in the
United Nations Organization Stabilization Mission in the Democratic Republic of the Congo**

Rec. no.	Recommendation	Critical[1]/ Important[2]	Accepted? (Yes/No)	Title of responsible individual	Implementation date	Client comments[3]
	controls; and (v) log critical processing activities (i.e., edit, modify and delete flight transactions).					
7	DFS should undertake a business impact assessment of the Field Support Suite and document business continuity and disaster recovery procedures in accordance with the recovery prioritization requirements of the entire suite.	Important	Yes	Director ICTD	First quarter of 2017	DFS' comments are reflected in the report.
8	DFS should: (i) implement mechanisms to ensure that performance issues related to the Aviation Information Management System (AIMS) can be identified and resolved in a timely manner; (ii) comply with current procedures for service management using iNeed; and (iii) track and monitor the status of all change requests related to AIMS.	Important	No	NA	NA	DFS' comments are reflected in the report.