



Office of Internal Oversight Services

INTERNAL AUDIT DIVISION

AUDIT REPORT

Implementation of the Charles River trade order management system in UNJSPF

The implementation of Charles River has automated trade order management, but additional measures are needed to ensure an adequate level of security, support and integration

25 April 2011

Assignment No. AS2010/801/41

United Nations  Nations Unies

INTEROFFICE MEMORANDUM

MEMORANDUM INTERIEUR

OFFICE OF INTERNAL OVERSIGHT SERVICES · BUREAU DES SERVICES DE CONTRÔLE INTERNE
INTERNAL AUDIT DIVISION · DIVISION DE L'AUDIT INTERNE

TO: Mr. Warren Sach, Representative of the Secretary-General
A: for the Investments of the UNJSPF

DATE: 25 April 2011

REFERENCE: IAD: 11- **00374**

FROM: Fatoumata Ndiaye, Director
DE: Internal Audit Division, OIOS

Fatou

SUBJECT: **Assignment No. AS2010/801/41 - Audit of the implementation of the Charles River trade order management system in UNJSPF**
OBJET: **management system in UNJSPF**

1. I am pleased to present the report on the above-mentioned audit.
 2. Based on your comments, we are pleased to inform you that we will close recommendations 5 and 6 in the OIOS recommendations database as indicated in Annex 1. In order for us to close the remaining recommendations, we request that you provide us with the additional information as discussed in the text of the report and also summarized in Annex 1.
 3. Your response indicated that you did not accept recommendation 7. In OIOS' opinion however, this recommendation seek to address significant risk areas. We are therefore reiterating them and requesting that you reconsider your initial response based on the additional information provided in the report.
 4. Please note that OIOS will report on the progress made to implement its recommendations, particularly those designated as high risk (i.e., recommendations 2 and 10) in its annual report to the General Assembly and semi-annual report to the Secretary-General.
- cc: Ms. Angela Kane, Under-Secretary-General, Department of Management
Ms. Suzanne Bishopric, Director, Investment Management Division, UNJSPF
Mr. Swatantra Goolsarran, Executive Secretary, UN Board of Auditors
Mr. Rohan Wijeratne, Board of Auditors
Ms. Susanne Frueh, Executive Secretary, Joint Inspection Unit
Mr. Mario Baez, Chief, Policy and Oversight Coordination Service, Department of Management
Mr. Byung-Kun Min, Special Assistant to the USG-OIOS
Ms. Amy Wong, Programme Officer, Internal Audit Division, OIOS

INTERNAL AUDIT DIVISION

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EXECUTIVE SUMMARY

Audit of the implementation of the Charles River trade order management system in UNJSPF

The Office of Internal Oversight Services (OIOS) conducted an audit of the implementation of the Charles River trade order management system in the Investment Management Division (IMD) of the United Nations Joint Staff Pension Fund (UNJSPF). The overall objective of the audit was to assess whether the implementation of this system had delivered the expected benefits and addressed the specific requirements for a fully automated trade order management system. The audit was conducted in accordance with the International Standards for the Professional Practice of Internal Auditing.

OIOS is of the opinion that the implementation of Charles River has enabled IMD to bring about systemic improvements and attain the benefits of an automated, real time system for executing investment trades. However, the system was not implemented as originally envisaged, since additional software packages will have to be acquired to fully meet the requirements of a complete trade order management system. Also, to fully realize the benefits of the Charles River system, the following additional controls are required:

- IMD should document in sufficient detail how Charles River will be integrated with other planned applications (i.e., “Omgeo” for managing post-trade operations and “Murex” for delivering standard processes for accounting);
- IMD should document the data dictionary of the trade order management system in sufficient detail including classification levels, security, ownership and syntax rules;
- A complete post-implementation review should be performed documenting the benefits attained from Charles River, any uncompleted activities that need to be completed to fully achieve the desired results, and lessons learned for the future;
- Service interruptions should be prevented by allocating appropriate resources to support Charles River and developing a business continuity and disaster recovery plan;
- Standard operating procedures and policies should be updated to reflect the operational changes introduced with the acquisition of the new system; and
- Security breaches should be prevented by configuring the firewall rules filtering access to the database with more stringent network security settings.

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I. INTRODUCTION

1. The Office of Internal Oversight Services (OIOS) conducted an audit of the implementation of the Charles River trade order management system in the Investment Management Division (IMD) of the United Nations Joint Staff Pension Fund (UNJSPF). The audit was conducted in accordance with the International Standards for the Professional Practice of Internal Auditing.

2. UNJSPF was established by the General Assembly to provide retirement, death, disability and related benefits for the staff of the United Nations and the other organizations admitted to membership of the Fund. UNJSPF comprises the Secretariat and IMD. IMD is responsible for managing the Fund's portfolio of investments.

3. General Assembly resolution 61/240 dated 13 March 2007 called upon the Investment Management Service (now IMD) "to expeditiously implement the recommendations of the Board of Auditors with regard to the determination of the level of tolerance for risk, improvement in internal review of performance and the trade order management system". With regard to the trade order management system, at the time of the General Assembly's resolution, IMD had already issued a request for proposal (RFPS-1025) on 27 December 2006.

4. RFPS-1025 stated that IMD intended to procure a platform allowing authorized users to trade any security listed on any stock exchange, private equities, real estate, and connecting all the parties involved in an electronic straight through processing (STP) using the industry-standard protocol for messaging "FIX" (Financial Information Exchange), or similar technology. The required solution included the main functions or fully integrated modules for portfolio management, trade order placement and execution, and compliance management.

5. The system selected and acquired as a result of the completed procurement process was Charles River (contract no. PD/C006/09). The implementation of this system was completed in 2010. IMD explained that given the length of time between the original definition of the system's requirements (2006) and the actual acquisition of the system (2009), not all functionalities were implemented (such as portfolio management and processing of all classes of assets) since they were not available in the acquired application envisioned in the original RFPS. However, IMD maintained that since Charles River represents one of the leading trade order management systems in the market, all the requirements originally defined in the RFP will be achieved through its integration with other commercial software packages.

6. The Information Systems Section (ISS) of IMD is responsible for managing the above-mentioned systems. Its responsibilities include the support for technology, applications, policies, procedures and management of information and communication technology (ICT) projects dedicated to the investment process, namely: portfolio management; trade order execution (straight-through-processing); investment pre-and-post compliance; portfolio risk analysis and performance measurement for different asset classes; back-office

support; reporting and reconciliation of different databases; custodians' master record keeper; brokers and real-time market data. ISS performs systems analysis to translate complex investment processes into complex technical requirements, and procures technology to support the investment processes.

7. The total cost of the Charles River project was approximately \$585,800 comprising \$341,000 for acquisition of the software and \$244,800 for professional services.

8. The Secretary-General's report A/C.5/65/2 dated 21 September 2010 stated that the adoption of Charles River allowed IMD to implement systemic improvements, creating an infrastructure that will benefit the Fund for years to come, reducing costs and enhancing the security of funds transfers. The report stated that between 30 May and 31 August 2010, trades worth over \$3.74 billion were executed through Charles River. In particular, the following benefits were identified from implementing the system:

- (i) Compliance with industry standards;
- (ii) Replacement of the previous fax-based manual system, reducing risk of erroneous transactions or fraud;
- (iii) Preventing the risk of "rogue trades", since no single person can launch a transaction;
- (iv) Implementing pre-trade compliance features, ensuring that investment orders are checked for conformity with investment policies; and
- (v) Audit trail of all transactions executed through the system.

9. Comments made by IMD are shown in *italics*.

II. AUDIT OBJECTIVES

10. The main objectives of the audit were to:

- (a) Assess whether the implementation of Charles River has delivered the expected benefits and addressed the specific requirements for a fully automated trade order management system as originally defined;
- (b) Examine the integrity and security afforded to transactions and summary data processed within the system and its interfaces; and
- (c) Ascertain that all options available within the application have been considered and those selected are fully implemented and appropriate for the business.

III. AUDIT SCOPE AND METHODOLOGY

11. The audit was conducted at UNJSPF/IMD Headquarters in New York. Interviews were held with the officers responsible for relevant functions, relevant documentation was reviewed, and tests were conducted to assess the various functionalities of the application. The audit considered the relevant policies and procedures of the United Nations Secretariat, IMD and professional best practices (i.e., Control Objectives for Information and related Technology, COBIT).

12. The audit did not review the procurement process for the acquisition of the Charles River system and the consultancy services for its implementation.

IV. AUDIT FINDINGS AND RECOMMENDATIONS

A. Functional requirements and acceptance testing

13. The implementation of a new information system should be based on a series of preliminary steps dedicated to documenting the definition of requirements of the functional users and examining the functionalities offered by the proposed system. These steps should be supported and complemented with review meetings and users' sign-offs. These activities should be conducted in accordance with a standard project management methodology that prescribes the definition of details related to: (i) Availability; (ii) Efficiency; (iii) Integrity; (iv) Performance; (v) Reliability; (vi) Scalability; and (vi) Usability.

14. The RFP issued in 2006 provided a description of the Fund's activities and processes at that time, presenting: (i) Overview of the Fund; (ii) Scope of the services; (iii) Equity investment universe; (iv) Equity and real estate investment purchase, sale recommendations and orders; and (v) Equity trade confirmation. A limited indication of functional requirements was included in the project section of the document with standard descriptions that included: (i) order and trade management system functionalities; (ii) roles and responsibilities; (iii) interfaces and customization; (iv) coordination between IMS and the Vendor; (v) system flowcharts; (vi) databases; (vii) glossary of terms; (viii) application interfaces; and (ix) security and authorization. Other than this, there was no documentation to show that the requirements of the functional users had been solicited and considered while defining the system's requirements.

15. IMD explained that consideration of the requirements of functional users was met by the IMD Investment Manual (dated 2010) and the several workshops and meetings held with functional users during the implementation of the system, as well as documentation of the "to-be" workflows. In this regard, OIOS noted that the documented "to-be" workflows were limited to the representation of the "to-be" process of the IMD Equities Trading Workflow using Charles River, and the "as-is" process of the IMD Foreign Exchange and Fixed Income Trading. The document did not specify the "to-be" workflows of the full system. As a result, it was not possible to determine which business requirements will be met by

Charles River, and which ones will be met by acquiring additional software packages. Without such a detailed definition, it was not possible to trace the specific functionalities that were implemented, tested and delivered.

16. IMD had developed a testing master document (testingmaster20100212.02.xls) containing several worksheets including data load, users, privileges, navigation and operations. However, the relevance of this document was limited because: (i) the tests had been conducted only by ICT staff members rather than the business users who should have confirmed the adequacy of the new procedures as implemented and supported by the new system; and (ii) many of its parts were blank, incomplete or lacking approval, whereby essential information was missing on whether the tests were successful and the system was ready to be deployed.

17. User acceptance tests had been conducted by IMD during training sessions. However, there was no documentation to show that a comprehensive test plan had been prepared, and the various test scenarios evaluated. Also, there was no evidence that problems encountered had been documented and addressed. During the audit, some functional users stated that certain limitations of the Charles River system were discovered only in production. For example, limitations were found in the ability of Charles River to correctly process real estate, forex, alternative assets (private equity), and accrued interest. These limitations should have already been known by IMD staff since the ICT strategy of the Division, issued in 2009, envisioned the acquisition of multiple applications to address all the requirements of a complete trade order management system.

Recommendation 1

(1) The Investment Management Division/UNJSPF should prepare a post-release report documenting: (a) the functionalities of the Charles River system as deployed in production; (b) any problems encountered or corrections made as a result of the user training sessions; (c) change requests, modifications and corresponding costs; and (d) acceptance of the system by the functional users.

18. *IMD accepted recommendation 1 and stated that it is in the process of retaining a consultant to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. There is a provision in the pending budget proposal for this consultancy. Recommendation 1 remains open pending receipt of a post-review report documenting: (a) the functionalities of the Charles River system as deployed in production; (b) any problems encountered or corrections made as a result of the user training sessions; (c) change requests, modifications and corresponding costs; and (d) acceptance of the system by the functional users.*

B. Software acquisition

Acquisition and integration

19. Charles River was acquired in 2010 on the basis of requirements established in 2006 (RFPS-1025-2006). These requirements were not supported by an ICT strategy or business case.

20. IMD developed an ICT strategy in 2009, designing an information architecture in which the original requirements established in 2006 would be achieved through the acquisition of multiple applications instead of one single system as envisioned in the original RFP. This was because Charles River does not include portfolio management and does not process all types of assets, such as fixed income, forex (FX) and real estate. IMD explained that the integration of Charles River with other applications that it plans to implement, such as “Omgeo” (for managing post-trade operations through the automation and timely confirmation of the economic details of trades between investment managers, hedge funds, broker/dealers and banks) and “Murex” (a platform delivering standard processes and coverage for accounting), will address all the requirements originally envisaged in 2006.

21. OIOS is of the view that IMD needs to update its ICT strategy to show how all the objectives originally envisioned while acquiring an automated trade order management system will now be achieved with the integration of Charles River and other future systems (“Omgeo” and “Murex”). Also, before acquiring the “Omgeo” and “Murex” systems, IMD needs to ensure data consistency and compatibility between those future systems and Charles River.

Recommendation 2

(2) The Investment Management Division/UNJSPF should document in sufficient detail how the Charles River system will be integrated with the other planned applications (“Omgeo” and “Murex”) to fully achieve the objectives envisioned while acquiring the trade order management system.

22. *IMD accepted recommendation 2 and stated that this recommendation does not involve an elevated business risk to the management of the UNJSPF as it relates to its management of operational risk. Rather it speaks to, as do many of the recommendations, the need to document process flows including activities, decision points, interrelationships, and systems. IMD further indicated that is in the process of retaining a consultant to address such matters; to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. The objective is to gain value from the documentation process. There is a provision in the pending budget proposal for this consultancy.*

23. OIOS defines high risk recommendations as those which, if not implemented, will most likely lead to the occurrence or recurrence of an

identified high risk event with a serious impact on the department/entity's mandate, operations or reputation. OIOS considers recommendation 2 as high risk because after more than three years from the General Assembly resolution requesting the implementation of a fully automated trade order management system, IMD has not yet defined how and when this objective will be fully achieved. Recommendation 2 remains open pending receipt of evidence detailing how and when the Charles River system will be integrated with the other planned applications ("Omgeo" and "Murex") to fully achieve the objectives originally envisioned.

Data dictionary and step catalogs

24. OIOS' review of the documentation for implementing the business applications in IMD showed that the documented workflows and step catalogs did not define data classification levels, security, ownership, and syntax rules (data dictionary). These definitions should have determined the level of protection to apply to information, raise awareness about critical information resources being processed through Charles River, and ultimately allow IMD to implement a strong access controls system (i.e., Role Based Access Control). As further explained in Section C of this audit report, inadequate configuration of the access control system allowed an external consultant to execute trades in the production environment of Charles River. Although IMD justified the execution of these trades, such instances could expose the Fund to considerable risk.

25. Also, the documented workflows and step catalogs had not been updated since they still indicated that trades of fixed income and foreign exchange are manually performed using the fax machine.

Recommendation 3

(3) The Investment Management Division/UNJSPF should document the data dictionary of the trade order management system with details related to classification levels, security, ownership and syntax rules.

26. *IMD accepted recommendation 3 and stated that it is in the process of retaining a consultant to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. There is a provision in the pending budget proposal for this consultancy.* Recommendation 3 remains open pending receipt of a documented data dictionary of the trade order management system.

C. Implementation

27. IMD contracted the services of an external consulting company (R.T.M. Group LLC) for the implementation of Charles River. The configuration of the production system was done through the use of programmes (scripts) that copied the settings adopted in the development and testing platforms. This automatic copy of the settings from development/testing to production extended to user profiles and accounts, including an account created for an external consultant

assisting IMD in the configuration of the system. As a consequence, this consultant executed two trades in the production environment in the amount of \$15 million. IMD explained that given the time sensitive nature of the trades, and the absence of the concerned staff members, the Senior Investment Officer and IMD Compliance Officer made a one-time exception for the consultant to be allowed to process these trades.

28. OIOS is of the opinion that the situation described by IMD in relation to the execution of trades by an external consultant highlights two main control weaknesses, as follows:

- (i) The absence of staff members should be one of the basic scenarios to be addressed in the business continuity plan of IMD for managing and maintaining a real-time application such as Charles River; and
- (ii) Proper segregation of duties should prevent the Compliance Officer from assuming operational responsibilities and authorizing trades.

29. Also, the Officer-in-Charge (OIC) profiles configured in the “production” system through the copying procedure from the “development/testing” environment were assigned to Senior Investment Managers (SIMs). Therefore, SIMs had two active profiles in the production system. This duplication may lead to potential conflict of interest.

30. OIOS brought to the attention of IMD management the risks deriving from this condition. IMD confirmed that in Charles River three individuals have been allowed, on a permanent basis, to authorize trades greater than \$50 million. These individuals include the IMD Director, the Deputy Director for Investments and the Deputy Director for Risk and Compliance. In their absence, a senior investment officer (SIO) is designated as officer-in-charge, following a procedure designed to mitigate the risk of having one officer approving trades under and over the \$50 million authorization limit. In accordance with this procedure, the Compliance Section monitors the allocation of these authorizations through a permission forms that are reflected into the system by the Information Technology Section. On the basis of IMD’s response and documentation provided, no recommendation is issued on this matter.

D. Post-implementation review

31. The main benefits derived from the implementation of Charles River were indicated in the “Report by the Representative of the Secretary-General for the Investments of the United Nations Joint Staff Pension Fund” (JSPB/57/R.23/Add.1, dated 24 May 2010). OIOS acknowledges that the implementation of Charles River has enabled IMD to bring about systemic improvements and attain the benefits of an automated, real time and secure system for executing investment trades. However, as explained previously, the system could not be implemented as originally envisaged, since additional software packages will have to be acquired to fully meet the requirements of a

complete trade order management system. Also, to fully realize the benefits of Charles River, a number of additional controls should be implemented, as explained in the present report.

32. The Secretary-General's report of 24 May 2010 included a summary assessment of the main results achieved with the adoption of the new system. However, OIOS is of the opinion that a comprehensive and systematic post-implementation review of the project would benefit IMD and the relevant stakeholders to draw upon the experience gained and lessons learned from implementing Charles River, so that these could be used while undertaking future projects.

Recommendation 4

(4) The Investment Management Division/UNJSPF should complete a post-implementation review of the Charles River system documenting: (i) how the project attained the desired results and benefits; (ii) any uncompleted activities that need to be completed to fully achieve planned results; and (iii) lessons learned in project management that would be useful for future projects.

33. *IMD accepted recommendation 4 and stated that it is in the process of retaining a consultant to address such matters; to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. The objective is to gain value from the documentation process. There is a provision in the pending budget proposal for this consultancy.*

34. Recommendation 4 remains open pending receipt of the results of a post-implementation review of the Charles River system documenting: (i) how the project attained the desired results and benefits; (ii) any uncompleted activities that need to be completed to fully achieve planned results; and (iii) lessons learned in project management that would be useful for future projects.

E. Training

35. Functional users were trained during two-hour sessions given by ISS, received end-user documentation and, in general, considered the training to be adequate. With regard to the end-user documentation, OIOS noted that it did not clearly specify the different roles and profiles configured in the system. As a consequence, the Front Office and the Back Office had questions as to their respective ownership in the creation or change of trade settings.

36. In response to OIOS' request for further evidence of the controls mechanisms implemented in this area, IMD provided an end-user documentation manual revised on 15 December 2010, detailing the segregation of duties and roles in the use of Charles River. Based on the documentation provided by IMD, no recommendation is issued in this matter.

F. Maintenance

37. An internal service level agreement has been established in IMD for the assistance provided by ISS in the following areas: Desktop Hardware/Software; Laptop Hardware/Software; E-Mail Accounts and Access; Remote Access; Scanning Services; Security; Charles River IMS Client; Wilshire Omega & Abacus; Bloomberg; Thomson DataStream; Fixed-Income; Thomson Vestek Portfolio Analytics; MATLAB Client; and SWIFT (Society for Worldwide Interbank Financial Telecommunication) messaging.

38. A tracking system, phone line, and email address have been set-up to enter and track help-desk tickets.

39. However, the help-desk in ISS is composed of only four staff, with only one staff member providing support for the Charles River system. Considering that IMD is planning the implementation of new systems (i.e., “Murex”, “Omgeo” and “Risk Metrics”), the limited availability of support staff could negatively impact the efficiency and effectiveness of this function.

Recommendation 5

(5) The Investment Management Division/UNJSPF should allocate appropriate resources to ensure adequate support of the Charles River system.

40. *IMD accepted recommendation 5 and stated that additional ISS Staff are in the process of being retained. The final implementation of this recommendation is dependent on the Office of Human Resources Management. Based on the action taken by IMD, recommendation 5 has been closed.*

G. Application controls

41. OIOS reviewed the control mechanisms configured in Charles River and noted the following.

Trade limits

42. All trade orders require approval from two different Senior Investment Officers. Trade Orders above \$50 million require the approval of the Director of IMD. However, since the compliance test of Charles River is based on the amount of one trade, and not on the aggregate amounts of the trades executed by a Senior Investment Officer (SIM), the rule requiring the approval of the Director could be circumvented by making multiple trades under the threshold limit of \$50 million. A SIM does not have to fulfill a trade recommendation with one trade only. The trade recommendation enables the SIM to use the allotted sum at his/her discretion. Although the audit results did not show any instance of circumvention of the \$50 million limit, there was the risk that circumvention could occur.

43. The Compliance Officer explained that the risk of circumventing the prescribed threshold is addressed by several procedures established in IMD, such as: (a) the daily and weekly trade blotter, and the quarterly compliance review that would eventually capture such activity; (b) the recently increased dollar limits that have proven to be adequate in allowing the Investment Officers to create trades that are appropriate to the investment weightings of their portfolios; (c) the concentration rules built into the compliance module of Charles River; and (d) the Northern Trust analysis and the soon-to-be-implemented “Risk Metrics” system that would allow the monitoring of individual security and sector holdings and detect in a timely manner any large deviation from acceptable weightings due to an inappropriate dollar investment.

44. Considering the concentration rules built into the system, which prevent a single SIM from purchasing the same type of equity beyond the specified limit, the mechanisms established by IMD appeared to adequately mitigate the risk of circumventing the thresholds for trade orders.

Compliance tests

45. Pre-trade compliance tests are set-up in Charles River and are run systematically on all equity trades. Forex and fixed income trades are executed outside Charles River but are entered in Charles River for settlements. Compliance rules are executed even though these trades have been executed outside Charles River.

46. All modifications on a trade are logged and captured in the audit trail of the trade, which is not editable. All trades processed with the system are kept in the database and cannot be deleted from Charles River.

47. The Compliance Office performs regular checks on all trades and raises alerts and continuously observes the trade blotter in Charles River. Daily and weekly reports are received by the Compliance Office from the trade blotter which are again reviewed, signed and dated.

48. A quarterly compliance review is also performed, and all rules in the compliance manual are reviewed. The Compliance Office receives the list of transactions from Northern Trust, samples the trades from all of the different regions, and checks for “Trade Recommendations”, “Advisor Recommendations” and dollar amounts.

Affirmation matching

49. The UNJSPF/IMD Operations Manual has been updated with reference to the new Charles River system, specifying controls and checklists. The Operations Section checks all trades and SWIFT messages before sending them to the global custodian. However, because the “affirmation matching component” is not yet implemented, Operations Section has to manually check all the trades. These manual checks may create a bottleneck in the system, since Operations can only handle a certain maximum number of trades per day. In this regard, Operations indicated that the current maximum capacity of the Cash

Management Unit is 15 trades per staff member if the trade requirements are complete, or 8 trades per staff member if the requirements are incomplete. Should the number of trades increase above these thresholds, the current staff resources in the Cash Management Unit would be unable to adequately handle the workload. This would expose IMD to risks related to unsettled trades.

Recommendation 6

(6) The Investment Management Division/UNJSPF should ensure that adequate staff resources are assigned to Operations until the “affirmation matching component” is deployed.

50. *IMD accepted recommendation 6 and stated that an additional Cash Management Assistant is being hired as General Temporary Assistant to complement the current staffing until all systems are in place and the affirmation matching component is operating effectively. Pending completion of this staffing exercise, an Accounting Assistant is being pulled to settlement duties as necessary and shortfalls in his/her regular work is being completed on overtime. Based on the actions taken by IMD, recommendation 6 has been closed.*

Authorization of changes

51. Operators may have to modify the content of the SWIFT message for correction purposes. Portfolio Assistants can modify – if necessary - the limit price of a trade but the procedure did not provide for a second review and the system does not prevent them from implementing changes. OIOS brought to the attention of IMD management the risks deriving from this condition. IMD reviewed this matter further and determined that the front office will have the responsibility to direct the back office in making any changes (price, commission, shares, etc.) to trade tickets. Therefore, IMD confirmed that the front office will pre-authorize any changes to be made by the portfolio assistants and operators with regard to price, commissions, and shares. Based on the actions taken by IMD, no recommendation is issued on this matter.

Supporting trading documentation

52. Trade recommendations are paper-based and do not have unique identifiers. Trades entered in Charles River were not coded for correlation with their corresponding trade recommendation(s). During its quarterly review, the Compliance Office researches the original documentation that supported the trades by referencing the date of the transaction. OIOS is of the view that the traceability of the trades could be improved through the use of tracking identifiers on trade recommendations and the actual trades executed.

Recommendation 7

(7) The Investment Management Division/UNJSPF should implement a mechanism for storing trade

recommendations and assigning them a unique identifier to automatically generate trade tickets.

53. *IMD did not accept recommendation 7, stating that a trade recommendation does not have a direct link with a trade ticket. Therefore, in IMD's knowledge, this recommendation is not acceptable. IMD intends to implement in the future a system to record trade recommendations and link them with trade orders. This system is not considered as a high priority at this point. And it is viewed as a separate project not related but linked to Trade Order Management System. OIOS is of the opinion that the traceability of orders is important for supporting the periodic review performed by the compliance function. Therefore, since IMD intends to implement such a system, recommendation 7 remains open pending receipt of evidence demonstrating the implementation of a mechanism for storing trade recommendations and assigning them a unique identifier to automatically generate trade tickets.*

Standard operating procedures

54. The UNJSPF “Standard Operating Investment Policies and Procedures” of February 2010 (AC19) have not been updated to reflect the operational changes introduced with the implementation of the Charles River system. These procedures describe the operations of IMD, provide an overview of the policies to be followed in the management of the investments, and codify procedures and controls. They are intended to be the basic reference for all those engaged in the investment decision-making process. Adherence to policies, procedures and practices contained in these operating procedures helps to ensure that the investment goals and objectives set out in the applicable regulations and policies established for the Fund are met. These operating procedures would cease to be a reliable reference if they are outdated and do not reflect the established workflows.

Recommendation 8

(8) The Investment Management Division/UNJSPF should review and update the Standard Operating Investment Policies and Procedures to reflect the operational changes introduced with the implementation of the Charles River system.

55. *IMD accepted recommendation 8 and stated that it is in the process of retaining a consultant to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. There is a provision in the pending budget proposal for this consultancy. Recommendation 8 remains open pending receipt of the documented standard operating investment policies and procedures to reflect the operational changes introduced with the implementation of the Charles River system.*

Security controls

56. The technical architecture of the Charles River system is based on three components: (i) middle tier application server; (ii) database server; and (iii) FIX server. In the current configuration of the firewall rules, these servers can be accessed from all IMD workstations through ports using the secure shell (SSH) and the display manager control (XDMCP) protocols for Unix-based servers, or remote desktop protocol (RDP) for Windows-based servers. In OIOS' opinion, these ports should be accessible only from the workstation(s) of the system administrators. Also, in case of emergency (i.e., business continuity and disaster recovery), system administrators should be able to remotely connect to the servers in a secure manner (i.e., using a Virtual Private Network).

Recommendation 9

(9) The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund's Secretariat, should: (i) change the firewall rules for accessing the Charles River servers limiting access to systems administrators for the SSH, XDMCP and RDP protocols; and (ii) deploy systems for allowing systems administrators to remotely connect to the servers in a secure manner.

57. *IMD accepted recommendation 9 and stated that this request was already submitted and implemented by IMSS. In addition, IMD requested a monitoring report as defined in the Service Delivery Agreement signed with IMSS. At this point the monitoring report has not been provided as requested and IMD/ISS is following up with IMSS.* Recommendation 9 remains open pending receipt of evidence showing: (i) change in the firewall rules for accessing the Charles River servers limiting access to systems administrators for the SSH, XDMCP and RDP protocols; and (ii) deployment of systems for allowing systems administrators to remotely connect to the servers in a secure manner.

H. Business continuity, disaster recovery and support

58. IMD indicated that business continuity and disaster recovery is an ongoing project that should be completed by mid-December 2010, for which a Service Delivery Agreement (SDA) had been established with the International Computing Centre (ICC) in Geneva. In this regard, OIOS noted the following:

- (i) A project plan was available and an actual "connectivity test" of the disaster recovery plan was performed from New York to Geneva. Phase 1 of the disaster recovery setup has been accomplished according to the plan. The Charles River middle tier is installed in Geneva and can be used via remote desktop, while a secure connection (via virtual private network or VPN) is available through the web (i.e. the Geneva site can be accessed from anywhere);

(ii) The Charles River database was replicated to Geneva in real time. A fully automated backup was in place (full backup). However, restoration has not been tested on the test platform. It was tested at the disaster recovery site using a back-up of the production database, before the replication started; and

(iii) Notwithstanding the measures already implemented by IMD, the arrangements for business continuity and disaster recovery were still limited by the following:

a. While the Charles River system had been in production since January 2010, the disaster recovery plan was not yet available at the time of the audit;

b. A switch-over from the production server to the disaster recovery site would take approximately 20 minutes;

c. The connections for the financial information exchange (FIX) protocol must be set-up on the disaster recovery site in order to obtain a fully available replicated site;

d. No supporting documentation existed and recovery time objective had not been specified; and

e. End-users were not aware of, and had not been involved in, the disaster recovery solution.

Recommendation 10

(10) The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund's Secretariat, should document and implement in a timely manner a disaster recovery and business continuity plan with the approval of all stakeholders.

59. *IMD accepted recommendation 10 and stated that it has made considerable progress with its Disaster Recovery Programme. IMD Staff has successfully worked from a remote location. Rollover testing to a data recovery site (Geneva) has also taken place. The IMD Disaster Recovery and Business Continuity Plan are under continual review and testing. This recommendation does not involve an elevated business risk to the management of the UNJSPF as it relates to its management or operational risk. Rather it speaks to, as do many of the recommendations, the need to document process flows including activities, decision points, interrelationships, and systems. IMD is the process of retaining a consultant to address such matters; to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. There is a provision in the pending budget proposal for this consultancy.*

60. OIOS maintains that recommendation 10 relates to a high risk area because the Charles River system is a real-time processing system that must be supported by an effective, complete and tested business continuity and disaster recovery plan. Therefore, recommendation 10 remains open pending receipt of evidence demonstrating that IMD has documented and implemented a disaster recovery and business continuity plan with the approval of all stakeholders.

ICT Support

61. The Information Management Systems Service (IMSS) of the Fund's Secretariat and the Information Systems Section (ISS) of IMD established an SDA for the provision of ICT Shared Infrastructure Services.

62. In accordance with the SDA, periodic reports should have been generated for monitoring the performance of the technical infrastructure as well as the resource utilization of the supported systems, including Charles River.

63. User support and system maintenance were accomplished using forms, such as User creation, Change Request, and firewall request form. However, there is no documented procedure on how to process the forms.

64. There was also no documented procedure on how to monitor the system, and there are no check-lists in place for the system administrators.

Recommendation 11

(11) The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund's Secretariat, should document system administrative tasks, maintenance and support procedures.

65. *IMD accepted recommendation 11 and stated that it is in the process of retaining a consultant to inventory existing documentation, draft documentation, review and finalize documentation, establish an annual review process, and to establish and monitor measures. There is a provision in the pending budget proposal for this consultancy.* Recommendation 11 remains open pending receipt of evidence showing that system administrative tasks, maintenance and support procedures have been documented.

V. ACKNOWLEDGEMENT

66. We wish to express our appreciation to the Management and staff of IMD for the assistance and cooperation extended to the auditors during this assignment.

STATUS OF AUDIT RECOMMENDATIONS

Recom. no.	Recommendation	Risk category	Risk rating	C/O ¹	Actions needed to close recommendation	Implementation date ²
1	The Investment Management Division/UNJSPF should prepare a post-release report documenting: (a) the functionalities of the Charles River system as deployed in production; (b) any problems encountered or corrections made as a result of the user training sessions; (c) change requests, modifications and corresponding costs; and (d) acceptance of the system by the functional users.	Governance	Medium	O	Document: (a) the functionalities of the Charles River system as deployed in production; (b) any problems encountered or corrections made as a result of the user training sessions; (c) change requests, modifications and corresponding costs; and (d) acceptance of the system by the functional users.	31 March 2012
2	The Investment Management Division/UNJSPF should document in sufficient detail how the Charles River system will be integrated with the other planned applications (“Omgeo” and “Murex”) to fully achieve the objectives envisioned while acquiring the trade order management system.	Governance	High	O	Detail how and when the Charles River system will be integrated with the other planned applications (“Omgeo” and “Murex”) to fully achieve the objectives envisioned while acquiring the trade order management system.	31 December 2011
3	The Investment Management Division/UNJSPF should document the data dictionary of the trade order management system with details related to classification levels, security, ownership and syntax rules.	Information Resources	Medium	O	Document the data dictionary of the trade order management system with details related to classification levels, security, ownership and syntax rules.	31 December 2011
4	The Investment Management Division/UNJSPF should complete a post-implementation review of the Charles River system documenting: (i) how the project attained the desired results and	Governance	Medium	O	Document a post-implementation review of the Charles River system detailing: (i) how the project attained the desired results and benefits; (ii) any uncompleted activities that need to be completed to fully achieve	31 December 2011

Recom. no.	Recommendation	Risk category	Risk rating	C/O ¹	Actions needed to close recommendation	Implementation date ²
	benefits; (ii) any uncompleted activities that need to be completed to fully achieve planned results; and (iii) lessons learned in project management that would be useful for future projects.				planned results; and (iii) lessons learned in project management that would be useful for future projects.	
5	The Investment Management Division/UNJSPF should allocate appropriate resources to ensure adequate support of the Charles River system.	Operational	Medium	C	Implemented.	
6	The Investment Management Division/UNJSPF should ensure that adequate staff resources are assigned to Operations until the “affirmation matching component” is deployed.	Operational	Medium	C	Implemented.	
7	The Investment Management Division/UNJSPF should implement a mechanism for storing trade recommendations and assigning them a unique identifier to automatically generate trade tickets.	Information Resources	Medium	O	Implement a mechanism for storing trade recommendations and assigning them a unique identifier to automatically generate trade tickets	Not provided
8	The Investment Management Division/UNJSPF should review and update the Standard Operating Investment Policies and Procedures to reflect the operational changes introduced with the implementation of the Charles River system.	Operational	Medium	O	Document standard operating investment policies and procedures to reflect the operational changes introduced with the implementation of the Charles River system	31 March 2012
9	The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund’s Secretariat should: (i) change the firewall rules for accessing the Charles	Information Resources	Medium	O	Implement the following actions: (i) change the firewall rules for accessing the Charles River servers limiting access to systems administrators for the SSH, XDMCP and RDP protocols; and (ii)	31 March 2012

Recom. no.	Recommendation	Risk category	Risk rating	C/O ¹	Actions needed to close recommendation	Implementation date ²
	River servers limiting access to systems administrators for the SSH, XDMCP and RDP protocols; and (ii) deploy systems for allowing systems administrators to remotely connect to the servers in a secure manner.				deploy systems for allowing systems administrators to remotely connect to the servers in a secure manner	
10	The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund's Secretariat, should document and implement in a timely manner a disaster recovery and business continuity plan with the approval of all stakeholders.	Information Resources	High	O	Document and implement in a timely manner a disaster recovery and business continuity plan with the approval of all stakeholders	31 March 2012
11	The Investment Management Division/UNJSPF, in coordination with the Information Management Systems Service in the Fund's Secretariat, should document system administrative tasks, maintenance and support procedures.	Operational	Medium	O	Document system administrative tasks, maintenance and support procedures.	31 March 2012

1. C = closed, O = open

2. Date provided by IMD in response to recommendations.