



AUDIT OF THE MANAGEMENT FRAMEWORK FOR SPACE EXPLORATION ACTIVITIES
RELATED TO SCIENCE AND THE USE OF THE INTERNATIONAL SPACE STATION
AUDIT REPORT



PREPARED BY
AUDIT AND EVALUATION DIRECTORATE

DECEMBER 2021

Audit of the Management Framework for Space Exploration Activities Related to Science and the Use of the International Space Station

May 13, 2022

Aussi disponible en français sous le titre *Audit du cadre de gestion des activités d'exploration spatiale liées à la science et à l'utilisation de la station spatiale internationale*

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Cat. No. ST99-81/2022F-PDF (Electronic PDF, French)

ISBN 978-0-660-43256-4

Cat. No. ST99-81/2022E-PDF (Electronic PDF, English)

ISBN 978-0-660-43255-7

<https://asc-csa.gc.ca/eng/terms.asp>

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1.0 SUMMARY

1.1 AUDIT OBJECTIVE

The objective of this audit is to determine whether the existing management framework allows the Astronauts, Life Sciences and Space Medicine (ALSSM) program (henceforth referred to as “the program”)¹ to achieve its objectives and to comply with relevant policies, regulations and guidelines issued by the Canadian Space Agency (CSA) and the central agencies.

1.2 AUDIT OPINION

In our opinion, the existing management framework allows the program to achieve its objectives and comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.

1.3 STATEMENT OF ASSURANCE

As Chief Audit Executive, I am of the opinion that sufficient and appropriate auditing procedures were followed and that evidence was gathered to establish the accuracy of the opinion provided in this report. This opinion is based on a comparison of the conditions as they existed at the time of the audit and the pre-established audit criteria that were agreed upon with management. This opinion applies to the assessed entity only. The evidence was gathered in compliance with the Treasury Board’s internal auditing policy, guidelines and standards. The procedures followed comply with the professional standards of the Institute of Internal Auditors. The evidence gathered is sufficient to convince senior management of the validity of the opinion derived from the internal audit.

1.4 SUMMARY OF FINDINGS

Our audit demonstrated that the ALSSM program established and implemented sound mechanisms to ensure that space exploration activities related to science and the use of the International Space Station are planned and controlled effectively. We found that the program activities are aligned with the priorities of the CSA and were established following a thorough analysis of needs and opportunities. The program has a work plan that describes and prioritizes activities. Furthermore, we found that the desired outcomes of activities are monitored effectively and are compared with the forecast outcomes throughout their lifecycles, in compliance with CSA governance processes. We also found that appropriate reporting is carried out for all program activities.

Financial resource planning is a challenge for the program. For the last two fiscal years, we found that between 25% and 35% of the budget allocated at the start of the year was not spent by year-end. These surpluses are mainly due to the ongoing pandemic and to the delay in project completion. It should be noted that measures were promptly taken to reallocate funds to other CSA sectors. This ensured that the program did not have lapsed funds and was able to continue meeting its operational objectives. The program is also evaluating options to implement management tools that will optimize the use of available resources, while taking into account its capacity. Given the context and the actions being taken, no recommendations have been made.

¹Space exploration activities related to science and the use of the International Space Station (ISS) are managed by the Astronauts, Life Sciences and Space Medicine (ALSSM) program.



Chief Audit Executive signature

Audit team members

Dany Fortin, Johanna Gailer and Jérémy Poulin

2.0 AUDIT REPORT

2.1 BACKGROUND

The Space Exploration Branch provides innovative technologies and qualified Canadian astronauts to foster discovery through space missions. Notably, the branch manages activities related to science and the use of the International Space Station (ISS) under its ALSSM program. Since 2010, research has been conducted and scientific instruments developed aboard the ISS. Scientific experiments related to health issues are conducted onboard with the aim of reducing astronauts' health risks during long-duration missions. At the same time, scientific research is performed to increase understanding of health issues on Earth for the benefit of Canadians. The program also gives Canadian astronauts the opportunity to fly and conduct space missions aboard the ISS. Canada's contributions to ISS assembly and maintenance have resulted in allocation to Canada of 2.3% of ISS utilization time, which represents approximately 20 hours of crew time per six-month period.

The six expected outcomes identified in the Global Indicators Reference for the program are as follows:

- Sustained access to scientific data
- Stakeholders' engagement is maintained/increased
- Expanded Canadian presence in space through space missions
- Canadian space exploration sector is better positioned to seize space opportunities
- Enhanced transfer of know-how and technology to other applications/entities
- Increase knowledge about universe, solar system and human capacity to live in space

To date, approximately 20 Canadian studies have been conducted aboard the ISS. The budget for activities related to science and the use of the ISS is approximately \$12 million per year. This includes approximately \$5 million for salaries.

2.2 AUDIT OBJECTIVE, SCOPE AND APPROACH

PURPOSE

The objective of this audit is to determine whether the existing management framework allows the ALSSM program to achieve its objectives and to comply with relevant policies, regulations and guidelines issued by the Canadian Space Agency (CSA) and the central agencies.

SCOPE

The audit concerned all activities related to science and the use of the ISS. Activities related to astronauts, such as recruitment, training and space missions, were excluded from this audit because they were evaluated in 2019. We selected and examined projects, contracts, agreements and payments made or active as of April 1, 2019.

APPROACH

The audit criteria were established according to management best practices and the requirements of the acts, policies, regulations and guidelines issued by the CSA and the central agencies. It should be noted



that the audit objective, risks and criteria were discussed with the audited entity. The audit criteria are set out in [Appendix A](#). The audit involved various audit processes, including interviews and document review.

We examined:

- 4 projects
- 3 grants and contributions agreements
- 7 procurement contracts

Our audit sample was selected based on the highest monetary values, project lifecycles and payments made as of April 1, 2019.

2.3 FINDINGS, RECOMMENDATIONS AND MANAGEMENT RESPONSE

Expected outcomes

To determine whether the existing management framework allows the ALSSM program to achieve its objectives and to comply with relevant policies, regulations and guidelines issued by the CSA and the central agencies, we expected to find the following outcomes:

- Activities are planned appropriately, meaning
 - ✓ short- and long-term activity planning is carried out based on priorities, anticipated changes and expected outcomes;
 - ✓ effective financial resource planning is carried out based on planned activities; and
 - ✓ succession planning is carried out.
- Activities are controlled appropriately, meaning
 - ✓ projects (activities) are planned, implemented and monitored in accordance with the CSA’s internal policies and directives;
 - ✓ contracts, contribution agreements and partnership agreements are awarded in accordance with CSA program terms and conditions and applicable acts, policies, regulations, directives and guidelines; and
 - ✓ spending authorizations are controlled, and expenditures are approved and incurred in accordance with acts and regulations.
- Activities are reported.

2.3.1 Activity planning

Audit objective	The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.	
FINDINGS	Criterion 1	Activities are planned appropriately.



<p>Audit objective</p>	<p>The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.</p>	
	<p>Condition</p>	<p>CONCLUSION ABOUT THE CRITERION:</p> <p>Short and long-term activity planning is carried out based on priorities and expected outcomes.</p> <p><i>The program activities are aligned with the priorities of the CSA and were established following an opportunities analysis.</i></p> <p>The audit found that the program effectively plans activities related to science and the use of the International Space Station (ISS) in the short and long term. The program has a work plan that describes and prioritizes activities. The groundwork for the current plan was laid during an overall planning exercise in 2019. The plan will remain in place until the end of the current ISS business cycle in 2024–2025. The work plan provides a detailed overview of all planned activities and financial resources. The plan is adjusted as necessary during the Annual Reference Level Update (ARLU). Furthermore, we found that activities are prioritized following a thorough analysis of the CSA’s internal and external environment. The program consults and collaborates with a number of internal and external stakeholders to prioritize specific areas of science that will allow the CSA to reach its objectives, further Canada’s role among international partners, and advance understanding of health issues on Earth. More specifically, activities are planned based on the 2.3% ISS utilization time allocated to Canada. Though this is a significant challenge, we found that the program successfully maximizes its allocated utilization time and gains additional time by taking advantage of opportunities for scientific collaboration with international partners.</p> <p>For the future of activities beyond 2024–2025, we found that at the time of this audit, planning was under way to determine future program directions and activities. A roadmap of space exploration missions is used to plan activities over a longer-term horizon. This roadmap is updated annually. The activities set out in the roadmap are clarified by the CSA’s consultation committees on space exploration, international working groups, foreign space agencies’ plans and strategies, dialogue with international</p>

<p>Audit objective</p>	<p>The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.</p>	
		<p>partners, national workshops and scientific publications. We found that the program uses a number of methods to identify major trends and weaknesses in the field of health research to identify research opportunities. We also found that a health sciences-related investment proposal on the use of the ISS beyond 2024 is being prepared. Currently, it takes 30 months to develop health science research, from the announcement of opportunity to the preparation of operations. The program is currently developing this proposal in preparation for maximizing ISS utilization time beyond 2024. Planning exercises are also under way in connection with the use of the Gateway and in connection with Health Beyond, a contribution project on health care for future human space missions.</p> <p><i>The program plans financial resources effectively based on planned activities.</i></p> <p>Our activities review found that financial resources are planned based on planned activities. The program work plan identifies the financial resources planned for each activity as well as the amounts at risk of not being used for the current year. Financial forecasts are entered in SAP software and approved in accordance with the CSA's <i>Financial Resources Management Guide</i> on a monthly basis. A one-pager is drafted at the end of each month to explain any discrepancies between the forecasts and the actual expenditures. In addition, change requests for activities are analyzed to identify impacts on the timeline, costs and expected outcomes of the investment. When necessary, new parameters are shared with the Integrated Investment Review Board (IIRB) for approval. Given the nature of its activities and their associated uncertainty, in accordance with organizational practices, the program conducts thorough planning using the tools available to the sectors. Despite this thorough planning, we still found a discrepancy between the forecasts from the start of the fiscal year and the actual expenditures of 35% and 25% for the 2019–2020 and 2020–2021 fiscal years, respectively. Forecasts are adjusted on a monthly basis and some funds are released over the course</p>

<p>Audit objective</p>	<p>The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.</p>	
		<p>of the year so that they can be used by other CSA sectors. Some of the discrepancies are explained by delays caused by the COVID-19 pandemic and delays in the development of technologies supporting scientific research. We also found that surpluses from the program contribution fund are transferred to another program. However, unused funds have not prevented the program from achieving the objectives set out in the Global Indicators Reference.</p> <p>At the time of this audit, the program was evaluating options for developing an integrated portfolio management tool to optimize the use of the resources allocated to the program, while taking its capacity into account.</p> <p><i>Succession planning is carried out.</i></p> <p>The program operates in the fields of operational space medicine and life sciences. This environment requires a variety of specialized expertise. According to current demographic data, out of the program’s 49 employees, 6 are eligible for retirement. We examined the mechanisms in place to ensure succession for these positions and found that appropriate succession planning is being carried out. We found that the program has a human resources management plan through 2022–2023 that anticipates and prioritizes vacant positions to be filled in the short term. We also found that the program analyzes future human resources needs. To meet these needs, four entry-level positions were created in the past year.</p> <p>Furthermore, we found that the program currently addresses issues related to organizational structure. Due to requirements resulting from position classification, the distribution of management responsibilities does not always allow technical specialists to fully focus their energies on added-value scientific activities. Management has taken steps to propose and implement solutions to these issues.</p>

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		Lastly, we found that the audited program contributes to the CSA's representation targets for two target groups: women and visible minorities.
	N/A	
RESPONSIBILITY IDENTIFIED	Organization	N/A
	Function	N/A
MANAGEMENT RESPONSE	N/A	
MANAGEMENT ACTION PLAN	Action plan details	Deadline
	N/A	N/A

2.3.2 Monitoring of activities

AUDIT OBJECTIVE	The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.	
FINDINGS	CRITERION 2	Activities are monitored appropriately.
	Condition	<p>CONCLUSION ABOUT THE CRITERION:</p> <p>Effective controls are in place within the program and facilitate adequate monitoring of activities.</p> <p><i>Activities are monitored and controlled effectively.</i></p> <p>Our projects review found that effective controls are in place and facilitate adequate monitoring of activities. Furthermore, the program's project management practices comply with the CSA's internal investment management directive, the Investment Governance and Monitoring Framework (IGMF). We found that projects are managed according to their level of risk and complexity. In addition, adequate controls are in place to validate the suitability of investments throughout their lifespan. Expected</p>



<p>AUDIT OBJECTIVE</p>	<p>The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.</p>	
		<p>outcomes are clearly established during the planning phase and are compared with forecast outcomes throughout the lifecycle. We also found that reliable information on project status is produced in a timely manner and supports decision-making. The program’s financial forecasts are reviewed and updated on a monthly basis.</p> <p>To determine whether activities are monitored and controlled effectively, we also analyzed adherence to costs and time frames for program project management. We concluded that the majority adhere to costs and time frames. The few discrepancies observed are the result of the COVID-19 pandemic and a delay due to technology development for a specific project. We found that, for the cases examined, an analysis had been carried out on impacts on expected outcomes to determine the best scenario for moving forward. The uncertain nature of scientific research required extending grants and contributions agreements to complete research in some cases.</p> <p><i>Contracts and contribution agreements are awarded and administered in accordance with CSA program terms and conditions and applicable acts, policies, regulations and directives.</i></p> <p>Our review found that contracts and contribution agreements are awarded and administered in accordance with applicable acts, policies, regulations and directives.</p> <p>We reviewed the awarding of a sample of seven contracts and found that the awarding of these contracts complied with the <i>Contracting Policy</i>. Furthermore, two out of the seven procurement contracts reviewed were sole-source. We found that there was sufficient justification for adopting this procurement strategy for each contract.</p> <p>We also reviewed the awarding of a sample of three grants and contributions agreements and found that these agreements complied with the terms and conditions of the overall grants and contributions program at the CSA. We found that Announcements</p>

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		<p>of Opportunity (AOs) are prepared, and proposals received, analyzed, evaluated and selected in accordance with planned procedures. We also found that AOs for scientific study initiatives are monitored by the CSA's Grant and Contribution Centre of Expertise. Consultations are held relative to these initiatives, whose objective is to grant contribution agreements to Canadian researchers, to ensure that appropriate funding mechanisms are used. AO planning tools are also available to the program, and a funding mechanism rationale form is completed at the start of the planning phase.</p> <p>Lastly, we reviewed a payment sample for each contract and grants and contributions agreement selected and found that expenditures are authorized and approved in accordance with the <i>Financial Administration Act</i> (sections 32, 33 and 34). We also found that expenditures are recorded appropriately and that expenditures and amendments over \$75,000 are approved by the IIRB.</p>
RECOMMENDATIONS	N/A	
RESPONSIBILITY IDENTIFIED	Organization	N/A
	Function	N/A
MANAGEMENT RESPONSE	N/A	
MANAGEMENT ACTION PLAN	Action plan details	Deadline
	N/A	N/A



2.3.3 Reporting










AUDIT OBJECTIVE	q	
FINDINGS	CRITERION 3	Activities are reported.
	Condition	<p>CONCLUSION ABOUT THE CRITERION:</p> <p>The audit found that all program activities are reported.</p> <p><i>Short-term reporting</i></p> <p>We found that the program carries out short-term reporting for all of its activities. A monthly dashboard is prepared and submitted to the Director General, Space Exploration, to provide information on the project performance indicators (costs, timeline, scope and risks). This information is also used to prepare a quarterly dashboard for CSA senior management. Contractors submit monthly progress reports for contracts awarded. In addition, a midpoint check-in is held with contribution recipients to monitor project progress. The program adheres to Treasury Board guidelines on proactive disclosure of contracts and grants and contributions.</p> <p><i>Program activities are promoted to Canadians.</i></p> <p>We found that project activities are promoted to Canadians. Numerous mechanisms and communication channels are used to promote program activities and spark an interest in science among Canadians. A variety of communications activities are organized, including blogs on the CSA website, virtual Q&A sessions with astronauts, social media posts and press conferences. The aim of these communications is to educate youth on the importance of STEM (science, technology, engineering and mathematics) in their daily lives and showcase the terrestrial benefits of scientific experiments conducted on the ISS. Although the program does not have an overarching communications plan, we found that a project-by-project approach is adopted and that the CSA communications group is consulted during the planning of each investment initiative in order to coordinate communications activities.</p> <p><i>Long-term reporting</i></p>

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AUDIT OBJECTIVE	q	
		<p>We found that the program carries out appropriate long-term reporting for all of its activities. The program has a Global Indicators Reference that sets out the targets the program needs to reach in order to meet its objectives. For 2019–2020, we found that the program reached, and sometimes exceeded, its objectives. Program stakeholders told us about the challenge posed by measuring indicators such as the number of peer-reviewed scientific publications resulting from CSA funding. It is difficult to keep track of the results of these publications, which are often released after the funding period for the studies. However, this indicator is considered important because it is used to compare the performance of this program with the performance of similar programs in other countries. We found that the program is taking steps to develop a bibliometric methodology to improve how these publications are tracked.</p>
RECOMMENDATIONS	N/A	
RESPONSIBILITY IDENTIFIED	Organization	N/A
	Function	N/A
MANAGEMENT RESPONSE	N/A	
MANAGEMENT ACTION PLAN	Action plan details	Deadline
	N/A	N/A



APPENDIX A – TERMS OF REFERENCE

Audit objective	The objective of this audit is to determine whether the existing management framework allows the program to achieve its objectives and to comply with all relevant policies, regulations and guidelines issued by the CSA and the central agencies.		
<u>Audit criteria</u>	<u>Audit sub-criteria</u>	Criterion met Criterion partially met Criterion not met	  
Criterion 1: Activities are planned appropriately.	Sub-criterion 1.1: Short- and long-term activity planning is carried out based on priorities, anticipated changes and desired outcomes.		
	Sub-criterion 1.2: Effective financial resource planning is carried out based on planned activities.		
	Sub-criterion 1.3: Succession planning is carried out.		
Criterion 2: Activities are monitored appropriately.	Sub-criterion 2.1: Activities are planned, implemented and monitored in accordance with the CSA's internal policies and directives.		
	Sub-criterion 2.2: Contracts, contribution agreements and partnership agreements are awarded in accordance with CSA program terms and conditions and applicable acts, policies, regulations, directives and guidelines.		
	Sub-criterion 2.3: Spending authorizations are monitored and expenditures are approved and incurred in accordance with acts and regulations.		
Criterion 3: Activities are reported.	Sub-criterion 3.1: Activities are reported.		