CANARIE Annual Business Plan 2019-20

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1 Overview

CANARIE is pleased to present its Annual Business Plan for fiscal year 2019-20 (FY20). The document includes past accomplishments as well as CANARIE's future plans to achieve its expected results. Risks and risk mitigation strategies are also presented.

CANARIE's programming and activities are defined by the following trends that are shifting the research and innovation landscape:

1) the digitization of research,

2) the use of data analytics in all research fields,

3) data preservation and reuse, and

4) the adoption of cloud technologies in all sectors.

These trends continue to drive CANARIE's programs, and investments into Canada's National Research and Education Network (NREN). In FY20, CANARIE will continue to launch and execute programs that build on strong foundations and evolve to support better alignment and integration of the components of Canada's digital research infrastructure.

CANARIE's planned activities include the ongoing evolution and expansion of the National Research and Education Network; management of the Research Software program and the expansion of the user community for these powerful research software tools; funding the development of Research Data Management software components and tools to enable Canadian researchers to adopt best practices; and the evolution of services, and a pilot of future capabilities, for the Digital Accelerator for Innovation and Research (DAIR) program. To complement its key programs, CANARIE will continue to offer value-added services (access and identity management solutions) to introduce efficiencies in research workflows as well as to improve the user experience. Lastly, CANARIE will continue to work with its private sector and academic partners in the Centre of Excellence in Next Generation Networks (CENGN), to support the rapid commercialization of leading-edge networking technologies.

2 About CANARIE

Role of CANARIE

CANARIE's role in Canada's innovation ecosystem was set out in its 1993 Articles of Incorporation: *to contribute to Canadian competitiveness in all sectors of the economy, to wealth and job creation and to the quality of life of Canadians.* CANARIE achieves this by designing and delivering digital infrastructure, and driving its adoption among Canada's research, education and innovation communities.

This direction to CANARIE to contribute to competitiveness "in all sectors of the economy" informs the horizontal perspective that CANARIE takes to Canada's innovation ecosystem. Rather than addressing the needs of a specific vertical sector, CANARIE looks across the public, private and not-for-profit research, education and innovation sectors to identify gaps, and then, through community engagement, works to address those gaps with a range of services and programs.

This horizontal view has driven CANARIE activities over the course of its history, and has helped shape Canada's digital infrastructure landscape. The following represents a sampling of these initiatives:

- laying the groundwork, with universities and provincial partner networks, for the first commercial Internet in Canada;
- incubating the Internet Registration Authority in Canada, now known as CIRA;
- supporting hundreds of Canadian businesses, educational and health organizations in their transition to digital models and processes via the Technology Development, Technology Diffusion program, Technology Applications Development program, and E-business, E-learning and E-health programs; and
- developing the grid certificate authority in Canada that provides secure access to data generated from the Large Hadron Collider and other advanced digital technologies.

More recently, CANARIE has:

- worked with provincial and territorial network partners to continually evolve what is arguably one of the world's leading National Research and Education Networks, which supports Canadians from coast to coast to coast engaged in advanced research, education and innovation;
- worked with global peers to align international research and education infrastructures to support globally collaborative research, including, most recently, direct Canadian access to Europe through the Montreal exchange called MOXY, and adding partners to increase the available capacity and resiliency of the shared transatlantic network link for research and education purposes to beyond 300Gb/s;
- ensured Canadians benefit from a robust Identity and Access Management framework, aligned with international frameworks, that provides secure access to digital services and resources in Canada and around the world;
- identified the gap in research software in the ecosystem and championed the development of powerful research software tools to accelerate discovery, including the creation of a software registry that makes reusable software tools available to all researchers;
- recognized the need to develop and evolve a national strategy for research data management by supporting Research Data Canada as it works with stakeholders to develop this strategy, and identified national gaps in research data management software and supported the development of research data management tools to make data findable, accessible, interoperable and reusable;

- engaged with digital research infrastructure providers and other stakeholders to provide advice and guidance on the evolution of the ecosystem to the Minister of Science; and
- incented Canada's small business community to embrace cloud computing technologies, providing more than 1000 businesses with cloud resources that enable rapid product development and accelerated time-to-market.

CANARIE's current activities build on these successes and respond to evolving research, technology and policy environments. CANARIE understands the value and impact of ever-increasing amounts of digital data on research, education and innovation, and works with stakeholders to ensure Canadians have the digital infrastructure ecosystem that can leverage these data assets to support Canadian leadership in multidisciplinary discovery and innovation.

CANARIE Funding

The majority of the funding for CANARIE is provided by the Government of Canada through a Contribution Agreement with Innovation, Science and Economic Development Canada. The Government of Canada's ongoing confidence and investment in CANARIE since 1993 is a testament to the critical nature of the infrastructure and the role that digital infrastructure plays in leveraging complementary government investments in research and innovation.

Focus of Activities: 2015 – 2020 Mandate

CANARIE's focus in its current mandate is on strengthening Canada's digital infrastructure ecosystem, as Canadians engaged in data-intensive, collaborative research and innovation are increasingly dependent on this critical infrastructure.

CANARIE also works with the community to improve the security of the NREN and of institutions connected to the NREN. Through the Joint Security Project, NREN partners and representatives from connected institutions worked collaboratively to develop a national view of the security position of the NREN and institutions connected to it.

CANARIE activities in the current mandate are focused on the following three areas, which align directly with the Expected Results outlined in CANARIE's Contribution Agreement with the Government of Canada.

Network Operations

In order to address the evolving needs of users in the research, education and innovation communities, CANARIE operates and evolves a pan-Canadian collaboration capability through the delivery of a world-class high performance network and network-based services. CANARIE will:

a) Increase network capacity and performance to keep pace with the growth in demand (currently an annual average growth rate of ~45%);

b) Expand network reach to address the needs of research and education communities from coast to coast to coast; and

c) Evolve the network services portfolio to enhance research, collaboration and innovation.

Technology Innovation

To bring new collaboration capabilities not previously offered to Canada's research community by creating and funding new software technologies. CANARIE will:

a) Drive the adoption of software tools and services to utilize and exploit data;

b) Increase the impact of tools and services to users;

c) Support research data management through the development of tools and applications; and

d) Promote the collaborative development of data management tools.

Private Sector Innovation

In order to leverage CANARIE resources to stimulate commercialization, CANARIE delivers a cloud-based program, the Digital Accelerator for Innovation and Research (DAIR) that enables advanced information and communications technology (ICT) research and provides an opportunity for entrepreneurs to accelerate time-to-market. CANARIE will:

a) Leverage the network to support innovation, development and adoption of transformative ICT technologies; and

b) Facilitate academic and private sector partnerships to drive collaborative innovation and commercialization.

To leverage the investment in the network, CANARIE supports CENGN's role to foster innovation and commercialization of new ICT technologies. In partnership with CENGN, CANARIE will:

a) Allow access to the CANARIE network to support the CENGN testbed.

3 2017-18 Accomplishments

The following sections describe CANARIE's accomplishments under each of the three Eligible Activities outlined in the Contribution Agreement that governs CANARIE's programs from 2015-2020:

3.1 Network Operations

To evolve and expand the CANARIE network in a flexible and cost-effective manner over the long-term, CANARIE's vision is to deploy fibre from coast-to-coast across Canada. In high-use, high-growth network corridors, CANARIE purchased fibre and therefore has the flexibility to add capacity and deploy transformative technologies at a considerably lower incremental cost. The alternative, which is a leased services model, has the cost/traffic curve that is linearly much higher, and would become prohibitively expensive as network traffic continues to grow exponentially.

In FY18, CANARIE

- Completed a number of new projects, which include:

    o Completed the Atlantic fibre system build, which offers the flexibility of adding services and capacity to the region.

    o Renewed the Western "reconfigurable optical add-drop multiplexer" (ROADM) segment.

    o Added redundancy in both the Winnipeg metro area and in the Atlantic regions.

- Continued to explore more cost effective alternatives to existing connections for increasing network capacity to the north, including providing a 10 fold capacity increase to the Yukon and Northwest Territories, bringing it to 100Mbps.

- Continued to work with provincial and territorial network partners to evolve the National Research and Education Network (NREN) through the NREN Program. Key accomplishments include:

    o Launched the third competitive funding call for the NREN Program.

    o Launched a project to deploy a Security Information and Event Management (SIEM) technology solution and the security staff required to support the technology, across the NREN, via the NREN Directed Funding Program.

    o Supported the acquisition and deployment of perfSONAR network measurement tool kits across the NREN.

    o Worked in partnership with the RANs to continue to implement the strategic plan for the NREN, which forms the basis for the NREN's work on shared national priorities and initiatives.

- Continued to represent Canada in other international initiatives to advance research and education networks, including the Global Lambda Integrated Facility (GLIF), an international consortium that provides advanced networking services to support data-intensive scientific research, and the Global NREN CEO Forum.

- Launched Canada's first Global Exchange Point for research and education, MOXY, in Montreal.

- Continued to operate the Canadian Access Federation (CAF), a service to enable higher-education communities to access Wi-Fi services (through *eduroam*) and other protected online content using their existing institutional credentials (i.e. username and password). Use of these services continues to increase with the addition of new participants and more wide spread use of eduroam and single sign-on technologies.

3.2   Technology Innovation

Research Software

CANARIE continued to champion the development of powerful research software tools that accelerate discovery and enable research funds to focus on research activity rather than software development. Research software enables users to seamlessly access digital infrastructure and resources without having expert knowledge of these infrastructures, thereby expanding use of these resources across many research domains.

These tools are available via CANARIE's online research software portal (science.canarie.ca). The online portal, the first of its kind in Canada, allows users to find reusable software services and examine each service's availability and usage statistics. The online portal creates a national clearinghouse for research software, and provides seamless access to advanced software tools in order to spur broad adoption by the research community.

In FY18, CANARIE

- Launched Research Software Call 2b, a $4.5M funding call for Research Software Platform development teams to modify and maintain an existing platform in order to meet the needs of at least one new research team.

- Continued to monitor the six projects funded through Call 1, and the five projects funded through Call 2a.

- Worked with the Canada Foundation for Innovation to produce a White Paper on Research Software.

- Began development of a Reusable Platform and planning for a Research Software Local Support Pilot.

Research Data Management

In FY18, CANARIE

- Launched a two step competitive call to support the development of software tools to bridge gaps in the Research Data Management ecosystem.

- Provided funding, consistent with community input, to support Research Data Canada (RDC). RDC is an organization whose overarching goal is to improve the management of research data in Canada. In FY18, RDC

  o Continued to work with both public and private organizations on the integration of best practices into Canadian research data management infrastructure. This outreach includes engaging the broader stakeholder community via webinars and blog posts, public presentations, workshops, and working groups.

  o Hosted the Canadian National Data Services Framework Summit.

- Co-hosted the 10th Research Data Alliance (RDA) Plenary in Montreal.

- RDC's Executive Director was one of six participants on the Leadership Council for Digital Research Infrastructure (LCDRI) subgroup working on recommendations to evolve the research data management ecosystem in Canada.

3.3 Private Sector Innovation

Under the Private Sector Innovation objective, CANARIE leveraged its infrastructure and relationships to support adoption of digital technologies by Canadian SMEs to advance innovation and commercialization.

In FY18, CANARIE

- Increased the aggregate number of Digital Accelerator for Innovation and Research (DAIR) users to 1080, up from 853 the prior year.

- Invested in improvements to the DAIR infrastructure.

- Developed marketing materials, including videos, to educate users on the most efficient use of cloud services.

- Carried out community consultations in order to inform the next generation of the DAIR program. Trials of a new DAIR program offering are expected to take place in FY19 and FY20.

- Continued to support the Centre of Excellence in Next-Generation Networks (CENGN) in a number of activities related to the development of its testbed. CANARIE is a founding partner in CENGN, a consortium of industry, academic and research leaders who are pooling their expertise and equipment to lower the commercialization barrier for Canadian SMEs and researchers.

4 2019-20 Planned Activities

FY20 is the fifth and final fiscal year of CANARIE's 2015-2020 mandate. In order to deliver on its expected results for the mandate, CANARIE will undertake the following activities in the 2019-20 fiscal year:

4.1   Network Operations

CANARIE will continue to undertake all required activities to support and evolve the existing CANARIE network and the services delivered over it.

1) Network Program – As a result of this program, the CANARIE network will continue to operate and evolve as essential research infrastructure to support research, education and innovation. To achieve the results of this program, the following activities will be undertaken in the 2019-20 fiscal year:

   i. Operate the network

   ii. Increase capacity, redundancy, and reliability

   iii. Continue to enhance network security and measurement monitoring tools

   iv. Continue to enhance user access to support tools

   v. Trial software-driven network services

   The following measurable short and medium term outcomes will be achieved in FY20:

   - Deployment of additional network capacity to meet the growing traffic need

   - Improved core node reliability

   - Improvement of network security monitoring and measurement system

   - Deployment of the Software Networking Pilot

   - Deployment of support tools accessible through the user portal

2) NREN Program – Through this program, CANARIE will continue to strengthen the impact of the co-delivery model with the regional networks to ensure greater consistency of access to infrastructure and services across the NREN. To achieve this, the following activities will be undertaken in the 2019-20 fiscal year:

   i. Extend capacity, redundancy, and reliability, and security through RAN networks

   ii. Extend 100Gbit/s reach outward from CANARIE

   iii. Connect institutional facilities

   iv. Strengthen NREN partnerships

   The following measurable short and medium term outcomes will be achieved in FY20

   - Execution of the NREN SIEM Deployment Project

   - Execution of projects funded under Call 3

   - Technical and financial audits of funded projects

   - Increased reliability and capacity on network segments shared by RANs

- Strategic alignment of NREN partners on the evolution of the NREN and the development and launch of projects to enhance security

2) Canadian Access Federation (CAF) Program – As a result of this program, Canada will continue to benefit from robust identity and access management services that enable secure and efficient remote access to distributed resources and tools, anytime. To achieve the results of this program, the following activities will be undertaken in the 2019-20 fiscal year:

   i. Adapt services to evolving standards

   ii. Increase awareness and adoption

   iii. Increase ease of service deployment, operation, and use

   iv. Expand identity services

   The following measurable short and medium term outcomes will be achieved in FY20:

   - Increased adoption of CAF services. CAF is projected to grow to 184 participants by the end of FY20 based on the FY19 projected count of 168.

3) Infrastructure Extension Program (IEP) – As a result of this program, government research institutes will continue to leverage the research network in support of collaborative research with national and international partners. To achieve the results of this program, the following activities will be undertaken the 2019-20 fiscal year:

   i. Provide high-speed network connections to government research facilities

   ii. Ensure connections are adequate to meet user needs

   The following measurable short and medium term outcome will be achieved in FY20:

   - Continue to support connections to government research facilities that meet the performance needs of the government science community.

4.2 Technology Innovation

1) Research Software – As a result of this program, CANARIE will continue to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers. To achieve the results of this program, the following will be undertaken in the 2019-20 fiscal year:

   i) Continue to enhance and promote the research software portal at science.canarie.ca

   ii) Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community

   iii) Support and monitor funded projects in Calls 2a and 2b (previously known as Call 3) in their development and/or maintenance phases

   iv) Technical and financial audits of funded projects

   v) Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers

   vi) Continue to deploy instances of a reusable research platform with select research teams to understand the issues involved in supporting a large number of researchers with a single research platform, designed with reuse in mind

vii) Work with participants in the Local Support initiative to support computational researchers at the institution level, including defining meaningful metrics and best practices

The following measurable short and medium term outcomes will be achieved in FY20:

- Maintain visits to science.canarie.ca consistent with FY19 levels

- Develop metrics and best practices for the Local Support Initiative

- Develop metrics and best practices for the Reusable Platform Initiative

- Execution of the development and maintenance portions of projects funded under Call 2a and 2b

- Financial audits of funded projects

2) Research Data Management – As a result of this program, CANARIE will contribute towards a future state where Canada's publicly funded data is available to accelerate discovery and commercialization by the academic and private sectors. The following activities will be undertaken in the 2019-20 fiscal year:

i. Community coordination in support of policy creation, national standards, infrastructure and tools

ii. National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations

iii. Communication with international data infrastructure organizations to work towards compatibility and interoperability with international approaches

iv. Support and monitor funded projects

v. Technical and financial audits of funded projects

The following measurable short and medium term outcomes will be achieved in FY20:

- Execution underway for all approved projects of the Research Data Management competitive call

- Development of an action plan for Canada's National Data Services Framework

- Host data management workshops with the heads of research in the university and college communities

- Financial audits of funded projects

4.3 Private Sector Innovation

The activities undertaken will include the delivery of the following programs, along with key initiatives listed under each program:

1) DAIR Cloud Testbed – As a result of this program, CANARIE will continue to leverage the CANARIE network to support Canadian firms' ability to develop and test innovative ICT applications. To achieve the results of this program, the following activities will be undertaken in the 2019-20 fiscal year:

     i. Operate the cloud platform (embracing updates to the platform core technologies as necessary)

    ii. Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market

   iii. Create and publish educational content related to efficient and secure use of cloud services

   iv. Launch a pilot project for the DAIR Evolution initiative, which will utilise a new hybrid cloud environment and support SMEs utilizing disruptive technologies

The following measurable short and medium term outcomes will be achieved in FY20:

- New features added to the DAIR cloud infrastructure

- Content released to educate SMEs on efficient use of cloud services

- Piloting the use of commercial cloud, combined with the existing DAIR private cloud, in providing extensible advanced cloud-based capabilities to SMEs for development of products and services

- Reduce the time and cost for SMEs to develop new technology skills by providing concise references, software examples, and documentation, packaged together as knowledge packages, which can be deployed on DAIR for study, characterization and ultimately implementation within an SME's product and/or service

2) CENGN Network Testbed – As a result of this program, the CANARIE network will be used to foster innovation and commercialization of new ICT technologies in partnership with CENGN. To achieve the results of this program, the following activities will be undertaken in the 2019-20 fiscal year:

     i. Ensure network connectivity and related support for CENGN test bed initiative

The following measurable short and medium term outcome will be achieved in FY20:

- Additional participants in CENGN will be able to leverage the CANARIE network to support advanced testing and demonstration of new ICT products and services

5 Program Delivery Timelines

Eligible Activities	Initiatives	2019-20			
		Q1	Q2	Q3	Q4
Network Operations					
Network Program	Operate the network		Ongoing		
	Increase capacity, redundancy, reliability	Next project to increase network redundancy			
	Continue to enhance network security and measurement monitoring tools		Process improvements of monitoring services		
	Continue to enhance user access to support tools		Development of support tools		
	Experimental software driven network services	Next project to create software driven services			
NREN Program	Extend capacity, redundancy, reliability, and security through RAN networks		Ongoing		
	Extend 100G reach outward from CANARIE		Ongoing		
	Connect institutional facilities		Ongoing		
	Strengthen NREN partnerships		Ongoing		
	Execution of the NREN SIEM Deployment Project		Ongoing		
	Execute third competitive call		Completion of projects		
	Technical and financial audits of funded projects		Ongoing		
	Increased reliability and capacity on network segments shared with RANs		Implementation of projects		
	Strategic alignment of NREN partners on the evolution of the NREN and the development and launch of projects to enhance security		Ongoing		
CAF Program	Adapt services to evolving standards		Ongoing		
	Increase awareness and adoption		Ongoing		
	Increase ease of service deployment, operation,and use		Ongoing		
	Expand on identity services		Ongoing		
IEP Program	Provide high-speed network connections to government research facilities		Ongoing		
	Ensure connections are adequate to meet user needs		Ongoing		
Technology Innovation					
Research Software Program	Continue to enhance and promote the research software portal at science.canarie.ca		Ongoing		
	Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community		Ongoing		
	Support and monitor funded projects in Calls 2a and 2b (previously known as Call 3) in their maintenance phase		Ongoing		
	Technical and financial audits of funded projects				Completion of projects
	Continue collaborative funding and awareness efforts with other funders and providers of research software, including international providers		Ongoing		
	Continue to deploy instances of a reusable research platform with select research teams to understand the issues involved in supporting a large number of researchers with a single research platform, designed with reuse in mind		Ongoing		
	Work with participants in the Local Support initiative to support computational researchers at the institution level, including defining meaningful metrics and best practices		Ongoing		
Research Data Management	Community coordination in support of policy creation, national standards, infrastructure and tools		Ongoing		
	National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly-funded research organizations		Ongoing		
	Communication with international data infrastructure providers to work towards Canadian research data infrastructure that is compatible with international approaches		Ongoing		
	Support and monitor funded projects in Call 1		Ongoing		
	Technical and financial audits of funded projects				Completion of projects
Private Sector Innovation					
DAIR Cloud Testbed	Operate the cloud platform		Ongoing		
	Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market		Ongoing		
	Create and publish educational content related to efficient use of cloud services		Ongoing		
	Launch a pilot project for the DAIR Evolution initiative, which will utilise a new hybrid cloud environment and support SMEs utilizing disruptive technologies	Continue launch of new features	Ongoing and Analysis		
CENGN Network Testbed	Network connectivity and related support for CENGN testbed initiative		Ongoing		

6 Financial Plan

Economic Action Plan 2015 announced $105 million in funding for CANARIE over five years to support the activities of CANARIE. CANARIE has identified a cash flow requirement of $27.3 million for the FY20 funding year.

CANARIE covenants and agrees to hold, invest, administer, and disburse that amount in accordance with the stipulations of the Contribution Agreement. No interest or investment income is payable by the Minister on the funds to be provided.

6.1 Program Revenues and Expenses (in 000s)

	FY16-FY19	FY20	FY21 Commitments	Total
REVENUES				
FUNDING				
ISED	77,700	27,300		105,000
TOTAL FUNDING	**77,700**	**27,300**		**105,000**
PROGRAM REVENUES				
User Fees	1,664	390		2,054
Interest Income	348	85		433
TOTAL PROGRAM REVENUES	**2,012**	**475**		**2,487**
TOTAL REVENUES	**79,712**	**27,775**		**107,487**
EXPENSES				
PROGRAM EXPENSES				
Network Operations				
Network Infrastructure & Services	44,835	8,989		53,824
NREN Program	9,332	3,351	317	13,000
Technology Innovation				
Research Software	7,892	4,333	2,668	14,893
Digital Infrastructure Innovation	1,020	2,963		3,983
Research Data Canada	1,136	364		1,500
Private Sector Innovation	3,332	1,205		4,537
TOTAL PROGRAM EXPENSES	**67,547**	**21,205**	**2,985**	**91,737**
Operating Expenses & General Overhead	12,125	3,625		15,750
TOTAL EXPENSES	**79,672**	**24,830**	**2,985**	**107,487**
EXCESS OF EXPENSES OVER REVENUES	**40**	**2,945**	**(2,985)**	**-**

6.2 Cost Recovery (in 000s)

The following table summarizes CANARIE's cost recovery projections for the next two fiscal years.

	FY20	FY21
CASH		
IEP End User Fees - federal	100	
IEP End User Fees - Non-federal	12	
CAF Participation Fees	278	
TOTAL CASH	**390**	
IN-KIND		
Research Software	743	525
Research Data Management	473	
TOTAL IN-KIND	**1,216**	**525**
MATCHING FUNDS		
NREN Program	941	
DAIR	32	
TOTAL MATCHING FUNDS	**973**	
TOTAL COST RECOVERY	**2,579**	**525**

Throughout FY20, CANARIE will continue to charge fees to users of CANARIE services and programs.

- As part of the legacy infrastructure extension program (IEP), CANARIE supports the costs to connect federal and non-federal labs to the NREN. The federal IEP connections cost recovery is a fixed annual amount paid by Shared Services Canada to offset the total annual cost of supporting these connections. For non-federal IEP connections, the amount in the budget represents 100% cost recovery of planned expenditures.

- The cost recovery for the CAF program will consist entirely of participation fees.

- In-kind cost recovery for the Research Software and Research Data Management programs represents a contribution from users that can include the time spent during development by the Principal Investigator, university faculty, project team or administrative staff.

- The overall NREN program will result in at least a 65/35 split of costs between CANARIE and other funding sources (e.g., provincial government, RAN's partner funds, etc.) for funded projects. CANARIE's contribution level will be determined on a project-by-project basis – i.e., some may have a higher than 65% contribution (up to 100%) from CANARIE, and others may be lower. CANARIE will ensure the outcome of the NREN program meets its overall cost recovery target, hence, greater priority will be given to projects which have leveraged contributions.

- The DAIR program expects to realize matching funds from its funded project.

6.3 Funding Requirements

As indicated in the Program Revenues and Expenses shown above in Section 6.1, CANARIE's cash requirement for the FY20 fiscal year (the final year of the current mandate) is $27.3 million. This is the balance remaining from the $105 million Contribution.

6.4 Investment Policy and Strategy

CANARIE shall continue to invest and manage any advanced funds according to investment policies, standards and procedures that a prudent person would follow in making investment decisions regarding property belonging to others. CANARIE will manage the funds in accordance with the Contribution Agreement and in particular, the investment directives contained in Article IV of the Contribution Agreement. The objectives are twofold: (a) to provide funds on an "as needed" basis to meet the disbursement needs of CANARIE and (b) to maximize the investment income earned by CANARIE, subject to the Investment Policy and Investment Strategy adopted by CANARIE.

The Investment Policy and the Investment Strategy specify permitted transactions, risk limitations for all market and credit risks faced by CANARIE, and levels of authority of officials who can commit CANARIE to different types of transactions. The Investment Policy and Investment Strategy must be updated at the beginning of the mandate and then reviewed annually. The Policy and Strategy were most recently updated, reviewed, and approved by the Audit and Investment Committee in October 2018. The Investment Policy is guided by the constraints contained in the Contribution Agreement.

7 Risk Assessment, Mitigation Strategies, and Performance Monitoring Strategies

Due to the diversity and complexity of the ecosystem CANARIE operates in, risk management is essential for CANARIE to achieve the expected results defined in the Contribution Agreement.

Identified risks are classified based on the likelihood of occurrence of the risk, as well as the severity of the negative impact of the risk. The treatment of identified risks will vary based on these two dimensions as per the table below:

			Likelihood		
			Low (LL)	**Medium (ML)**	**High (HL)**
Potential Impact	**Low (LI)**		Accept risks	Accept risks with monitoring	Monitor and manage risks
	Medium (MI)		Accept risks with monitoring	Develop formal risk mitigation measures	Develop formal risk mitigation plan
	High (HI)		Identify mitigation steps and monitor regularly	Develop formal risk mitigation measures and monitor regularly	Develop formal risk mitigation plan and monitor regularly

1) Risks to delivery of the Contribution Agreement expected results:

   a) Insufficient funds to meet emerging needs over the duration of the mandate (ML, MI)

   Risk Statement:

   The amount of funding has remained flat from the previous mandate and may hinder the organization's ability to fully deliver on its expected results.

   Risk Mitigation:

   - Where possible, continue to reduced fixed costs in the network as well as in the IEP program, as these represent the highest recurring annual costs to the organization;

   - Monitor cost recovery to ensure targets are being met; and,

   - Leverage Board oversight to ensure appropriate balance of investments across programs.

   b) Network Operations Risks (ML, MI)

   A critical component in undertaking the Network Operations activities is the completion and operationalization of the 100G national backbone from Halifax, NS, to Victoria, BC.

   Risk Statement:

There is a risk that fibre needed to complete certain segments is either unavailable or too costly to procure or maintain. Among other things, this would make CANARIE less agile to respond to the needs of the research community, as well as face ever-growing network costs through the use of a growing number of leased wavelength services.

Risk Mitigation:

- Establish and maintain senior level relationships with fibre and equipment providers;

- Engage Board and advisory committee members, where appropriate, to work within their organizations to support this initiative; and

- Identify suppliers of new fibre to build additional capacity in the main east-west network corridor.

c) Research Software Risks (LL, HI)

The Research Software program's goal is to develop software tools that enhance the usability and accessibility of research infrastructure for all Canadian researchers, while addressing a broader set of research disciplines.

Risk Statement:

Low adoption of the new interdisciplinary software development and the approach by the broader research and education community poses a significant risk to this program.

Risk Mitigation:

- Continued early engagement with research software developers and researchers using workshops, online communication tools etc.;

- Continued engagement with the Research Advisory Committee and ensuring its evolution to allow researchers' input to guide the program, while gaining their buy-in; and

- Strengthen alignment with other research software funders e.g. the CFI and Genome Canada, partnering with them to ensure greater synergies among funded platforms.

d) Research Data Management Risks (ML, LI)

The Research Data Management program goal is to develop research data management software tools that solve identified national gaps in tools to make data findable, accessible, interoperable and reusable.

Risk Statement:

National alignment on the use of research data management tools within a National Data Service Framework by the broader research and education community poses a significant risk to this program.

Risk Mitigation:

- Continued early engagement with data management personnel and software developers by using workshops, online communication tools, RDC advocacy etc.;

- Continued engagement with the Research Data Management Advisory Committee and ensuring its evolution to allow data management experts' input to guide the program, while gaining their buy-in; and

- Strengthen alignment with other organizations involved with research data management e.g. CARL / Portage and Compute Canada, partnering with them to ensure greater synergies among funded platforms.

e) Research Data Canada Risks (ML, LI)

The mission statement for Research Data Canada (RDC) is to work with stakeholders to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Statement:

There is a risk that the stakeholder community remains fragmented with limited alignment on the objective to ensure research data is re-usable in support of innovation that benefits all Canadians.

Risk Mitigation:

- Use of RDC working groups to address various topics required for alignment;
- Continued advocacy and engagement of stakeholders; and
- Advocacy of international best practices in research data management.

f) Private Sector Innovation Risks (LL, HI)

The main program supporting this eligible activity is the Digital Accelerator for Innovation and Research (DAIR) service. The primary goal of this program is to incentivize growth of Canada's ICT sector.

Risk Statement:

There is a risk that DAIR will not evolve to offer new services that are critical to the changing needs of the ICT sector, SMEs in particular and, therefore, becomes less relevant.

Risk Mitigation:

- Continuous interactions with SMEs and commercialization-supporting organizations (e.g. incubators, accelerators) to evolve the DAIR program;
- Marketing outreach programs to increase the awareness of the DAIR service;
- Working with other organizations that focus on SMEs such as IRAP to develop a consolidated offering; and
- Assess the utility of the service via user surveys and performance metrics.

2) Program Delivery Risks

a) Service Delivery via RANs (LL, HI)

Risk Statement:

The provincial and territorial RAN partners are separate organizations and, as such, may have objectives, which are not aligned with CANARIE objectives. As a result, this non-alignment could impact, or impede, CANARIE's ability to deliver on its mandate.

Risk Mitigation:

Ongoing effort to ensure alignment of provincial and territorial objectives with national objectives is essential. Specific activities include:

- Ongoing support for the NREN Governance Committee, comprised of CANARIE and RAN presidents;

- Creation of an NREN Business Strategic Plan to identity NREN priorities;

- Ensure program funding to the RANs is structured in a manner to assist in attaining NREN objectives that also support CANARIE's network objectives; and

- Ensure one CANARIE Board member represents RANs.

b) Attrition (ML-MI)

Risk Statement:

Loss of senior staff, key employees or key Board members could jeopardize the organization's ability to deliver on its programs.

Risk Mitigation

For Board members:

- Board members are asked for a minimum 3 year term commitment;

- The Vice-Chair is the planned successor to the Chair and agrees to a 6 year term commitment upon commencing as Vice-Chair; and

- The Governance and Nominating Committee meets at least quarterly.

For internal staff:

- Succession planning for key staff;

- Performance evaluation with career discussions with all employees every 6 months; and

- Ongoing IT investments for information and knowledge retention.

3) Performance Monitoring Strategies

CANARIE collects metrics internally for all its programs, services, and for the network. External performance metrics are collected from the community in the form of user surveys and reports, and reporting from the regional networks. CANARIE works with Innovation, Science and Economic Development to integrate this information as part of an overall performance management strategy. Additionally, performance data for each eligible activity are included as part of CANARIE's annual reporting.

8 Representation

CANARIE Inc. represents that it is not in default under the terms of the Contribution Agreement that is currently in force.