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CANARIE Annual Business Plan 2020-21

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1 Executive Summary

CANARIE is pleased to present its Annual Business Plan for fiscal year 2020-21 (FY21), the first year of the 2020-24 mandate. The document includes past accomplishments as well as CANARIE's plans to achieve its expected results. Risks and risk mitigation strategies are also presented.

Role of CANARIE

CANARIE strengthens Canadian leadership in science and technology by delivering digital infrastructure that supports world-class research and innovation.

CANARIE and its twelve provincial and territorial partners form Canada's National Research and Education Network (NREN). This ultra-high-speed network connects Canada's researchers, educators and innovators to each other and to global data, technology, and colleagues.

Beyond the network, CANARIE funds and promotes:

- national cybersecurity initiatives to strengthen institutional and NREN security;
- reusable research software tools and national research data management initiatives to accelerate discovery;
- identity management services to the academic community; and
- advanced networking and cloud resources to support commercialization in Canada's technology sector.

Established in 1993, CANARIE is a non-profit corporation, with the majority of its funding provided by the Government of Canada through a Contribution Agreement with Industry Canada. The Government of Canada's ongoing confidence and investment in CANARIE since 1993 is a testament to the essential nature of the infrastructure and the role that digital infrastructure plays in leveraging complementary government investments in research and innovation.

Focus of Activities: FY21 (April 1, 2020 to March 31, 2021)

CANARIE's focus in its new mandate is on amplifying the impact of Canada's digital infrastructure, as Canadians engaged in data-intensive, collaborative research and innovation are increasingly dependent on this critical infrastructure.

In FY21, 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.

In addition to the ongoing management of the CANARIE network and other programs, key planned activities and outcomes for FY21 include:

- Advancement of a Global Research and Education Network (GREN) map, to provide dynamic visualizations of global connectivity, down to the institutional level, including a pilot project utilizing data from the Canadian NREN;
- Deployment of additional network capacity to support Northern connectivity, and the establishment of a Nunavut Regional Advanced Network;
- Execution of projects under Research Software Call 3, the Local Research Software Support Call 1, Research Data Management Call 2, and NREN Call 1;

- Development of additional BoosterPacks for the DAIR cloud environment to catalyze the use of transformative technologies by Canadian SMEs;
- Launching a new funded cybersecurity program(s), to be defined in the final months of FY20; and
- Planning and related activities with the New Digital Research Infrastructure Organization (NDRIO) to facilitate the transition of Research Software, Research Data Management and Research Data Canada activities by the end of FY22.

Focus of Activities: 2020 – 2024 Mandate

CANARIE's programming and activities during the 2020-2024 mandate will be defined by the following trends that are shifting the research and innovation landscape:

- 1) the continued digitization of research,
- 2) the growing need for cybersecurity,
- 3) the adoption of cloud technologies in all sectors, and
- 4) the development of a new organization to manage the federal investment in advanced research computing, research data management, and research software.

CANARIE activities in the 2020-2024 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 deliver 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 (FY19 grew ~36.5% over FY18 annual traffic);
- b) Expand network reach and redundancy to address the needs of research and education communities from coast to coast to coast;
- c) Strengthen the overall security posture of the national research and education network, and better understand its vulnerabilities;
- d) Support the development of security capability at NREN-connected institutions; and
- e) Evolve the network services portfolio, including identity management, 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) Test network-driven and network-enabled technologies to support the research workflow;
- b) Drive the adoption of software tools and services to utilize and exploit data;
- c) Increase the impact of tools and services to users;

- d) Support research data management through the development of tools and applications; and
- e) Promote the collaborative development of data management tools.

Private Sector Innovation

In order to leverage CANARIE resources to stimulate commercialization, CANARIE will:

- a) Leverage the network to support innovation, development and adoption of transformative ICT technologies, including DAIR (the Digital Accelerator for Innovation and Research);
- b) Facilitate academic and private sector partnerships to drive collaborative innovation and commercialization; and
- c) Allow access to the CANARIE network to support the CENGN (Centre of Excellence in Next Generation Networks) testbed.

2 2018-19 Accomplishments

2018-19 (FY19) was the penultimate year of CANARIE's 2015-2020 mandate. The following sub-sections describe CANARIE's accomplishments in FY19 under each of the three Eligible Activities outlined in the Contribution Agreement that governed that mandate:

2.1 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 quickly and at a considerably lower incremental cost, especially as network traffic continues to grow exponentially. This connectivity is protected by leased services, which provide necessary network diversity.

In FY19, CANARIE

- Completed several new projects, which included:
 - Adding an additional 100G path along the southern route of the network from Seattle via Victoria to Montreal to provide 200G capacity across the country; and
 - Deploying a second CANARIE node in Toronto, at York University, to provide additional resiliency for Ontario institutions connected via the ORION network.
- Continued to work with provincial and territorial network partners to evolve the Canadian National Research and Education Network (NREN) through the NREN Program. Key accomplishments included:
 - Hiring security analysts in most NREN partner organizations, and running a pan-Canadian procurement for a common Security Information and Event Management network appliance across the NREN, to create a national NREN security community;
 - Collaborating with ORION (Ontario) and RISQ (Quebec) to share network services along the Toronto, Ottawa, and Montreal network corridors; and
 - Hosting the first ever NREN Assembly, to bring together staff from across the NREN in order to develop national operational priorities for the following year.
- Continued to represent Canada in international initiatives to advance research and education networks, including the Global NREN CEO Forum, and the Global Network Advancement Group (GNA-G) to ensure the Canadian NREN continues to support world-class research.
- Operated the Canadian Access Federation (CAF), a service to enable higher-education communities' access to secure online content through the Federated Identity Management service using their existing institutional credentials (i.e. username and password), and to Wi-Fi services (through *eduroam*).
 - Additionally, in FY19, CANARIE successfully piloted *eduroam* Visitor access (eVa) at four institutions. eVA is a service that provides secure guest access to institutions' Wi-Fi networks via *eduroam*.

2.2 Technology Innovation

Research Software

CANARIE continued to champion the development of powerful research software tools that accelerate discovery and enable researchers and research funding 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 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 FY19, CANARIE

- Launched a Local Research Software Support pilot, to demonstrate that further reduction of software duplication and accelerated discovery is possible through support for researchers on their campuses.
- Hosted the inaugural Canadian Research Software Conference.
- Monitored the projects funded through Research Software Calls 2a and 2b.

Research Data Management

The ability to reuse research data accelerates opportunities for creating new knowledge and maximizes the return on investment of research funding. In order to support Canada's research data management ecosystem, CANARIE funds the development of software and tools to support the research data management workflow and support the work of Research Data Canada.

In FY19, CANARIE

- Monitored the projects funded through Research Data Management Call 1.
- 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 FY19, RDC

- 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.
- Hosted the Canadian National Data Services Framework Summit, leading to the creation of the stakeholder-led Kanata Declaration, the development of a Research Data Management roadmap for the federal government, and the establishment of a Working Group to discuss a national approach to RDM training.

2.3 Private Sector Innovation

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

In FY19, CANARIE

- Increased the aggregate number of Digital Accelerator for Innovation and Research (DAIR) users to 1211, up from 1080 the prior year.
- Invested in improvements to the DAIR infrastructure, including adding support for Docker containers.
- Developed marketing materials, including videos, to educate users on all aspects of using cloud services.
- Began work on a DAIR pilot project, which allows Canadian SMEs to quickly learn new technologies, such as machine learning, how they may integrate them into their businesses and product offerings, and how to leverage the ongoing investments made by the private sector in Canadian cloud data centres.
- Continued to support the Centre of Excellence in Next-Generation Networks (CENGN) in 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.

See note at the beginning of the next section regarding reporting changes as a result of the new Contribution Agreement.

3 2019-20 Accomplishments to Date

Note: Given the new timeframe for the Annual Business Plan under CANARIE's 2020-2024 mandate, this Business Plan reports on items included in the Annual Business Plans for two fiscal years: FY19 and FY20. This enables alignment with the new reporting cycle. Moving forward, Annual Business Plans will only report on the fiscal year that immediately precedes it - e.g. the Annual Business Plan for 2021-22 will only contain a section on the accomplishments of 2020-21.

2019-20 (FY20) is the final year of CANARIE's 2015-2020 mandate. The following sections provide an overview CANARIE's accomplishments in FY20 to date under each of the three Eligible Activities outlined in the Contribution Agreement that governed that mandate, along with information on outstanding projects for completion.

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 quickly and at a considerably lower incremental cost, especially as network traffic continues to grow exponentially. This connectivity is protected by leased services, which provide necessary network diversity.

Thus far in FY20, CANARIE

- Added an additional 100G of connectivity along the southern path of its core network route from Montreal to Seattle
- Launched a Call for the second phase of the Joint Security Project, to provide both technical tools and opportunities to develop cybersecurity skills across the research and education community, and hosted workshops for funded participants in Ottawa and Vancouver
- Commenced work leading an international working group tasked with creating a dynamic visualization of the Global Research and Education Network
- Hosted the second annual NREN Assembly

Key projects to be completed before the end of FY20 include

- Launching *eduroam* Visitor access (eVa), a service to provide secure guest access to institutions' Wi-Fi networks via *eduroam*

3.2 Technology Innovation

Research Software

CANARIE continued to champion the development of powerful research software tools that accelerate discovery and enable researchers and research funding 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 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.

Thus far in FY20, CANARIE

- Launched a funding Call, to provide funding in the 2020-2024 mandate, to support research teams who will adapt existing research platforms for re-use by new research teams
- Launched a funding Call, to provide funding in the 2020-2024 mandate, for the Local Research Software Support initiative
- Hosted the second annual Canadian Research Software Conference in May 2019

Research Data Management

The ability to reuse research data accelerates opportunities for creating new knowledge and maximizes the return on investment of research funding. In order to support Canada's research data management ecosystem, CANARIE funds the development of software and tools to support the research data management workflow and support the work of Research Data Canada.

Thus far in FY20, CANARIE

- Launched a funding Call, to provide funding in the 2020-2024 mandate, to support collaborative interoperability and integration of data repositories and systems within Canadian and global digital research infrastructures
- Provided funding to the Canadian Association of Research Libraries' (CARL) Portage Network to build capacity and coordinate activities in research data management

Key projects to be completed before the end of FY20 include

- Hosting the 2020 National Data Services Framework Summit and a workshop for funded RDM projects, to be held in February 2020.

3.3 Private Sector Innovation

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

Thus far in FY20, CANARIE

- Announced the evolution of the DAIR program with the launch of BoosterPacks, packages of cloud resources and curated knowledge about emerging technologies

The balance of 2019-20 accomplishments will be captured in the Annual Report.

4 2020-21 Planned Activities

FY21 is the first fiscal year of CANARIE's 2020-2024 mandate. In order to deliver on its expected results for the mandate, CANARIE will undertake the following activities in the 2020-21 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 2020-21 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. Continue to develop software-driven network services

The following measurable short- and medium-term outcomes will be achieved in FY21:

- Deployment of additional network capacity to support traffic growth
 - Deployment of additional network capacity to support Northern connectivity
 - Improved core network reliability to provide network continuity under certain failure conditions
 - Improvement of network security reporting, monitoring and measurement system
 - Deployment of Software Networking Applications
 - Deployment of support tools accessible through the user portal
 - Development of commercial cloud support strategy
 - Launch of the Global Research and Education Network (GREN) map
- 2) Security – Through this program, CANARIE will continue to secure its own network and improve the overall security posture from the core of the network up to the end-user higher education institutions. To achieve the proposed goals of the security program, the following activities will be undertaken in the 2020-21 fiscal year:
 - i. Continue to evolve the Joint Security Project (JSP)
 - ii. Launch new cybersecurity funding program(s) based on the development of a national cybersecurity framework (discussions on framework are ongoing in FY20)
 - iii. Collaborate with over-the-network security offerings such as CanSSOC, and work to provide integrated security solutions
 - iv. Provide sustainable cybersecurity monitoring service by efficiently managing and integrating the SIEM (Security Information and Event Management) systems deployed on CANARIE infrastructure and network, and at each RAN location

- v. Operate the Distributed Denial of Service (DDoS) detection system dedicated to the CANARIE network and actively collaborate with RANs on validation of incident data and delivery of mitigation options
- vi. Promote and implement in-house cybersecurity expertise development for CANARIE's dedicated security staff and the NREN security analyst community

The following measurable short- and medium-term outcomes will be achieved in FY21:

- Enable data aggregation reporting for the benefit of the entire JSP community
 - Adoption of a cybersecurity framework that will be used internally in security assessments and continuous improvement of CANARIE security posture and cyber risk management
 - Definition and adoption of an internal Incident Response Plan
 - Implementation and maintenance of an active Vulnerabilities Management Plan to decrease CANARIE's attack surface
 - Deployment of Password Control and Identity Management (PAM/IAM) systems and Two Factor Authentication (2FA) where possible
- 3) NREN Program – The NREN Program initiatives will continue to evolve the NREN such that it acts in a coordinated manner to advance common national objectives, while respecting and leveraging the diversity within the federated model. NREN partner engagement will be increased, and initiatives will be better integrated to support this vision. To achieve this, the following activities will be undertaken in the 2020-21 fiscal year:
- i. Extend capacity, redundancy, reliability, and security through RAN networks
 - ii. Connect institutional facilities
 - iii. Strengthen cybersecurity of the NREN
 - iv. Update the NREN Strategic Plan
 - v. Strengthen the NREN in the North

The following measurable short- and medium-term outcomes will be achieved in FY21

- Interconnection Agreements executed with all CANARIE-approved RANs
 - Completion of first competitive funding call issued to meet RAN networks' requirements
 - Technical audits of funded projects
 - Increased reliability, capacity and security on network segments shared by RANs
 - Increase NREN security through continuation of the NREN SIEM project
 - Development and launch of projects to enhance security
 - Completion of an updated strategic plan to support the evolution of the NREN
 - Realization of a RAN in Nunavut
- 3) 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 2020-21 fiscal year:

- i. Establish CAF community 'baseline expectations' to streamline service administration
- ii. Develop more robust technical documentation and tutorials to simplify deployment, operation, and use of CAF services
- iii. Deploy initiatives and best practice guidelines to continue to evolve CAF service cybersecurity
- iv. Community outreach to increase the awareness and adoption of CAF services
- v. Research and development efforts focused on expanding identity management services

The following measurable short- and medium-term outcomes will be achieved in FY21:

- Increased adoption of CAF services. CAF is projected to grow to 196 participants by the end of FY21 based on the FY20 projected count of 184
- 4) 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 in the 2020-21 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 FY21:

- 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 2020-21 fiscal year:
- i) Continue to 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 platform Calls 2a and 2b in their maintenance phases
 - iv) Support and monitor funded projects in platform Call 3 in their development phase
 - v) Select projects under the Local Research Software Support Call 1 and support/monitor
 - vi) Continue to work with participants in the Local Research Software Support initiative (pilot and Call 1) to support computational researchers at the institution level, including defining meaningful metrics and best practices

- vii) Technical and financial audits of funded projects for Calls 2a, 2b and the Local Research Software Support Pilot
- viii) Host the 2020 Canadian Research Software Conference (CRSC)
- ix) Support the transition of activities to the new DRI organization at the end of FY22

The following measurable short- and medium-term outcomes will be achieved in FY21:

- Maintain visits to science.canarie.ca consistent with FY20 levels
- Enhanced documented metrics and best practices for the Local Research Software Support Initiative
- Execution of the development and maintenance portions of projects funded under platform Calls 2a, 2b and 3.
- Selection and execution of the first year of projects under Local Research Software Support Call 1
- Financial audits of funded projects for Calls 2a, 2b and the Local Research Software Support Call 1
- CRSC 2020 held and feedback from attendees documented

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 2020-21 fiscal year:

- i. Community coordination in support of open science, 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
- vi. Execution of activities in the RDC Roadmap to advance research data management priorities
- vii. Support the transition of activities to the new DRI organization at the end of FY22

The following measurable short- and medium-term outcomes will be achieved in FY21:

- Execution underway for all approved projects in Research Data Management competitive calls
- Development of an action plan for RDC’s outreach efforts, including Canada’s National Data Services Framework
- Financial audits of Call 1 funded projects completed

- Development and use of RDM services, tools and platforms that enable Canadians to adopt RDM practices and comply with evolving funder policy
- Development of end-of-project metrics that demonstrate the impact of targeted funding to the RDM community

4.3 Private Sector Innovation

The activities undertaken will include 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 2020-21 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 resources and services
 - iv. Create a community forum for information exchange between private sector innovators
 - v. Evolve the DAIR BoosterPack pilot project, which utilized a new hybrid cloud environment leveraging private sector investment in Canadian cloud infrastructure/services, and deliver BoosterPack training materials with source code developed by Canadian SMEs
 - vi. Cultivate strategic partnerships to add value for the DAIR user community, contributing toward the evolution of a consolidated cloud service

The following measurable short- and medium-term outcomes will be achieved in FY21:

- The total number of DAIR users is greater than 1500 by the end of FY21
 - New features added to the DAIR cloud platform
 - Content released to educate SMEs on cloud independence and security in the cloud
 - Report initial findings and outcomes of the BoosterPack pilot based on user consultation or questionnaire
 - Monitor ongoing cloud usage patterns of SMEs as they develop and test cloud-based applications and services
 - Provide additional BoosterPack Tutorials, in order to reduce the time and cost for SMEs to develop new technology skills
 - Further advance the partnership between DAIR and CENGN, making participant transitions between programs more apparent and seamless
- 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 2020-21 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 FY21:

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

4.4 Activities Supporting Equity, Diversity, and Inclusion

In order to advance equity, diversity and inclusion, the following activities will be undertaken in the 2020-21 fiscal year:

- i. Addition of institutional Equity, Diversity, and Inclusion plans as an adjudication criterion for funding selection
- ii. Equity, Diversity, and Inclusion advancement included as a topic in the evolution of the NREN Strategic Plan

The following measurable short- and medium-term outcome will be achieved in FY21:

- Development of an Equity, Diversity, and Inclusion advancement plan
- Development of an NREN Equity, Diversity, and Inclusion plan

5 Program Delivery Timelines

Eligible Activities	Initiatives	Ongoing	Projected or Actual Launch	Major Milestones	Projected Completion
Network Operations					
Network Program	Operate the Network				
	Increase capacity, redundancy, reliability - Milestone 1: Atlantic redundancy and improved reliability completed		2020-04-01	2020-12-19	2024-03-31
	Continue to enhance network security and measurement monitoring tools				
	Continue to enhance user access to support tools - Milestone 1: Global networking map - Canadian map simple visualization		2018-08-24	2020-09-28	2022-03-31
Security Program	Continue to develop software-driven network services - Milestone 1: Automated lightpath tests completed between regional networks and CANARIE		2020-04-01	2022-03-26	2024-03-31
	Continue to evolve the Joint Security Program (JSP) - Milestone 1: Additional 40 participants		2020-06-01	2020-08-28	2024-03-31
	Launch new cybersecurity funding program(s) based on the development of a national cybersecurity framework (discussions on framework are ongoing in FY20) - Milestone 1: Security Program 1st initiative launched - Milestone 2: 1st initiative funding begins		2020-04-01	2020-09-28 2021-03-01	2024-03-31
	Collaborate with over-the-network security offerings such as CanSSOC, and work to provide integrated security solutions - Milestone 1: Agreement on initial national security initiative - Milestone 2: 1st initiative funding begins		2018-09-25	2020-06-05 2020-07-03	2024-03-31
	Provide sustainable cybersecurity monitoring service by efficiently managing and integrating the SIEM systems deployed on CANARIE infrastructure and network, and at each RAN location				
	Operate the Distributed Denial of Service (DDoS) detection system dedicated to the CANARIE network and actively collaborate with RANs on validation of incident data and delivery of the mitigation options				
	Promote and implement in-house cybersecurity expertise development for CANARIE dedicated security staff and NREN security analyst community				
NREN Program	Extend capacity, redundancy, reliability, and security through RAN networks - Milestone 1: NREN Competitive Call #1 project selection - Milestone 2: NREN Competitive Call #1 projects start		2020-04-01	2020-10-07 2020-11-15	2023-03-31
	Connect institutional facilities - Milestone 1: NREN Competitive Call #1 project selection - Milestone 2: NREN Competitive Call #1 projects start		2020-04-01	2020-10-07 2020-11-15	2023-03-31
	Strengthen cybersecurity of the NREN - Milestone 1: Consultations - Milestone 2: Agreement on next initiative		2019-11-28	2020-10-05 2020-12-15	2024-03-31
	Update the NREN Strategic Plan - Milestone 1: Agreement on updated Plan		2019-11-28	2020-06-26	2024-03-31
	Strengthen the NREN in the North - Milestone 1: Connection agreement with new Nunavut regional network		2019-08-28	2020-12-31	2024-03-31
CAF Program	The establishment of CAF community 'baseline expectations' to streamline service administration - Milestone 1: Community consultation - Milestone 2: Participant agreements completed		2020-04-01	2021-03-31 2022-03-31	2022-03-31
	Development of more robust technical documentation and tutorials to simplify deployment, operation, and use of CAF services				
	Deploy initiatives and best practice guidelines to continue to evolve CAF service cybersecurity - Milestone 1: Security recommendations to community - Milestone 2: Rollout of recommendations complete		2019-11-01	2020-04-24 2020-12-18	2021-03-31
	Community outreach to increase the awareness and adoption of CAF services				
	Research and development efforts focused on expanding identity services				
IEP Program	Provide high-speed network connections to government research facilities				
	Ensure connections are adequate to meet user needs				

Eligible Activities	Initiatives	Ongoing	Projected or Actual Launch	Major Milestones	Projected Completion
Technology Innovation					
Research Software Program	Continue to enhance and promote the research software portal at science.canarie.ca				2022-03-31
	Continue to expand awareness of the Research Software program within the Canadian R&E community and the international research software community				2022-03-31
	Support and monitor funded projects in Calls 2a and 2b in their maintenance phases		2019-07-01		2020-09-30
	Support and monitor funded projects in platform Call 3 in their development phase - Milestone 1: Successful applicants selected and notified - Milestone 2: Start of development phase for selected projects		2019-09-03	2020-01-07 2020-04-01	2023-03-31
	Select projects under the Local Research Software Support Call 1 and support/monitor - Milestone 1: Call launched - Milestone 2: Successful applicants selected; funding starts		2019-04-12	2020-01-28 2020-06-01	2023-03-31
	Continue to work with participants in the Local Research Software Support initiative (pilot and Call 1) to support computational researchers at the institution level, including defining meaningful metrics and best practices				2020-09-30
	Technical and financial audits of funded projects for Calls 2a, 2b and the Local Research Software Support Pilot				2021-03-31
	Hold the 2020 Canadian Research Software Conference (CRSC)		2019-09-09		2020-05-16
	Support transition of activities to the new DRI organization at the end of FY22 - Milestone 1: First draft of Research Software program description and roadmap		2019-09-09	2020-05-01	2022-03-31
Research Data Management	Community coordination in support of open science, policy creation, national standards, infrastructure and tools				2022-03-31
	National engagement activities designed to facilitate the development and deployment of national data services that benefit all publicly funded research organizations - Milestone 1: Hold the 2021 National Data Services Framework Summit		2020-04-01	2021-02-03	2022-03-31
	Communication with international data infrastructure organizations to work towards compatibility and interoperability with international approaches				2022-03-31
	Support and monitor funded projects - Milestone 1: Successful applicants selected and notified - Milestone 2: Start of development phase for selected projects		2019-09-03	2019-12-05 2020-04-01	2022-03-31
	Technical and financial audits of funded projects				2023-06-30
	Execution of activities in the RDC Roadmap to advance research data management priorities				2022-03-31
	Support the transition of activities to the new DRI organization at the end of FY22 - Milestone 1: First draft of Research Data Management program description and roadmap - Milestone 2: First draft of Research Data Canada description and roadmap		2019-09-09	2020-05-01 2020-05-01	2022-03-31
Private Sector Innovation					
DAIR Cloud Testbed	Operate the cloud platform (embracing updates to the platform core technologies as necessary)				
	Enhance technical capabilities of the DAIR cloud infrastructure with features to help users reduce time to market				
	Create and publish educational content related to efficient and secure use of cloud resources and services				
	Create a community forum for the information exchange between private sector innovators - Milestone 1: Start of regular webinar sessions		2019-10-18	2020-05-10	2024-03-31
	Evolve the DAIR BoosterPack pilot project, which utilized a new hybrid cloud environment leveraging private sector investment in Canadian cloud infrastructure/services, and deliver BoosterPack training materials with source code developed by Canadian SMEs - Milestone 1: Call for additional BoosterPacks from SMEs - Milestone 2: First additional BoosterPacks available from SMEs		2019-01-06	2020-04-01 2020-08-28	2024-03-31
CENGN Network Testbed	Cultivate strategic partnerships to add value for the DAIR user community, contributing toward the evolution of a consolidated cloud service - Milestone 1: Pilot using CENGN infrastructure for DAIR - Milestone 2: Potential production use of CENGN infrastructure for DAIR		2019-12-11	2020-01-31 2020-06-19	2024-03-31
	Ensure network connectivity and related support for CENGN testbed initiative				

6 Representation and Financial Plan

The Government of Canada has invested \$137M to support CANARIE's activities from 2020-2024. Announced in the penultimate year of CANARIE's 2015-2020 mandate, the funding commitment ensures that CANARIE can continue to deliver strategic investments in infrastructure and services for Canada's research and innovation communities. CANARIE has identified a cash flow requirement of \$30.2 million for the 2020-21 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 Representation

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

6.2 Program Revenues and Expenses

The following table summarizes CANARIE's program revenue and expenses projections for the fiscal year.

	2020-21 (in 000s)
<i>REVENUES</i>	
FUNDING	
Government of Canada	30,200
TOTAL FUNDING	30,200
PROGRAM REVENUES	
User Fees	571
Interest Income	210
TOTAL PROGRAM REVENUES	781
TOTAL REVENUES	30,981
<i>EXPENSES</i>	
PROGRAM EXPENSES	
Network Operations	
Network Infrastructure & Services	13,500
Security	4,636
NREN Program	2,299
Technology Innovation	
Research Software	2,256
Research Data Management	897
Research Data Canada	401
Private Sector Innovation	1,333
TOTAL PROGRAM EXPENSES	25,322
Administrative Costs	4,647
TOTAL EXPENSES	29,969
EXCESS OF EXPENSES OVER REVENUES	1,011

6.3 Cost Recovery

The following table summarizes CANARIE's cost recovery projections for the fiscal year.

	2020-21 (in 000s)
CASH	
IEP User Fees - Federal	100
IEP User Fees - Non-federal	11
CAF Participation Fees	459
TOTAL CASH	571
IN-KIND	
Research Software	240
Research Data Management	105
TOTAL IN-KIND	345
MATCHING FUNDS	
NREN Program	567
DAIR	19
TOTAL MATCHING FUNDS	586
TOTAL COST RECOVERY	1,501

Throughout 2020-21, 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 NREN program will result in sharing 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. 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.

6.4 Funding Requirements

As indicated in the Program Revenues and Expenses shown above in Section 6.2, CANARIE's cash requirement for the 2020-21 fiscal year (the first year of our 2020-2024 mandate) is \$30.2 million.

6.5 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, 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. Investment decisions shall be made with the principal objective being the preservation of capital to meet future disbursement requirements.

The Investment Policy and the Investment Strategy specify permitted transactions and 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 reviewed annually: they were most recently reviewed, and approved by the Audit and Investment Committee in October 2019. The Investment Policy is guided by the constraints contained in the Contribution Agreement.

7 Performance Monitoring Strategies, Risk Assessment and Mitigation Strategies

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, reports and reporting from the regional networks. CANARIE works with the Minister to integrate this information as part of an overall performance management strategy. Additionally, performance data for each eligible activity is part of CANARIE's annual reporting.

Program Delivery Risks

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. Risk is reported on by Management and monitored by the Board of Directors.

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:

		Probability		
		Low	Medium	High
Impact	Low	Accept risks	Accept risks with monitoring	Monitor and manage risks
	Medium	Accept risks with monitoring	Develop formal risk mitigation measures	Develop formal risk mitigation plan
	High	Identify mitigation steps and monitor regularly	Develop formal risk mitigation measures and monitor regularly	Develop formal risk mitigation plan and monitor regularly

Please see Table below:

Risk Name	Description	Prob.	Impact	Risk	Mitigation Strategies and Action Plans
Network Operations Risks	Possibility that CANARIE is unable to find, or find at appropriate cost, fibre for certain network upgrades. Among other things, this would make CANARIE less agile in responding to the needs of the research community, as well as facing ever-growing network costs through the use of a growing number of leased wavelength services	M	M	MM	<ul style="list-style-type: none"> 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 Work with international community on key international routes. Continued identification of fibre suppliers
DAIR Service Relevance	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	L	H	LH	<ul style="list-style-type: none"> Development of DAIR 2.0 (BoosterPacks) to ensure relevant service offering Continuous interactions with SMEs and commercialization-supporting organizations Marketing outreach to increase the awareness of DAIR Working with other organizations that support SMEs to develop a consolidated offering Assess the utility of the service via user surveys and performance metrics
Failure of key international partner	The failure of a key international NREN (e.g. Internet2, GEANT, AARNet etc.) would both limit CANARIE's ability to provide service, and weaken our value proposition	L	H	LH	<ul style="list-style-type: none"> Maintain strong relationships with international partners to create mutual support Work with the international community on common initiatives that demonstrate value of the GREN
Research Software (R/S) Uptake	Possible low adoption of software development approach by the broader R&E community	L	H	LH	<ul style="list-style-type: none"> Engage with the R/S community Engagement with the Research Advisory Committee Strengthen partnerships with other R/S funders

Risk Name	Description	Prob.	Impact	Risk	Mitigation Strategies and Action Plans
Service Delivery via RANS	Should one or more RAN partners start to have objectives that are not aligned with CANARIE's, it could impact, or impede, CANARIE's ability to deliver on its own mandate	L	H	LH	<ul style="list-style-type: none"> • Ongoing support for the NREN Governance Committee, comprised of CANARIE and RAN presidents • Implementation of the NREN Strategic Plan to identify 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 • Ensure RANs are represented by a CANARIE Board member
JSP Alignment	Risk that participants in the JSP fail to collaborate in a meaningful way – e.g. on data sharing agreements – or that participants drop out due to lack of alignment	L	H	LH	<ul style="list-style-type: none"> • Signing up to the JSP Call demonstrates willingness to collaborate • Experience with the pilot will allow CANARIE to steer discussions to encourage alignment
RDM Alignment	Possible failure of the broader research and education community to align on tools and services within a National Data Services Framework	M	L	ML	<ul style="list-style-type: none"> • Engage with the RDM personnel and software developers • Engagement with the Research Data Management Advisory Committee • Strengthen partnerships with other organizations involved in RDM
RDC Alignment	Risk that the stakeholder community remains fragmented, with limited alignment on ensuring data reuse	M	L	ML	<ul style="list-style-type: none"> • Use of RDC Working Groups to encourage alignment • Continued advocacy and engagement with the broader RDM community • Advocacy for international best practices within Canada
eVa Deployment	Deployment of eduroam Visitor access has already been delayed, and there is a risk this continues past fall 2019 (promised delivery to the community) or beyond	L	M	LM	<ul style="list-style-type: none"> • Project implementation will be aligned with international community approach

Risk Name	Description	Prob.	Impact	Risk	Mitigation Strategies and Action Plans
Technology changes occurring mid-mandate	Given the length of CANARIE's mandate vs the pace of technological change, it is likely that new technologies or services arise that CANARIE has not budgeted for in the normal multi-year cycle	L	M	LM	<ul style="list-style-type: none"> • Budget flexibility • Innovation Fund • Board oversight on Operating Plan and Program changes and evolution