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DIGITAL NAVY

A Strategy to Enable Canada's Naval Team for the Digital Age

CANADIAN ARMED FORCES

FORCES ARMÉES CANADIENNES

National Defence · Défense nationale

Canada

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FOREWORD

DIGITAL NAVY INITIATIVE

I am pleased to introduce this *Digital Navy Initiative* for the dedicated members of the naval team who work ceaselessly to ensure that the Royal Canadian Navy is in all respects *Ready to Help, Ready to Lead,* and *Ready to Fight.* This initiative is for you and is intended to ensure you have the tools and capabilities needed to leverage the tremendous opportunities made possible through rapidly evolving digital technologies.

We have entered a new era where naval activities are more dependent on actions taken in the digital domain than ever before. From the business space to the battle space, the same digital technologies that are driving fundamental disruptive changes across the global economy are creating equally game-changing impacts throughout the naval enterprise. Increasingly, those organizations that find innovative ways to digitally empower their people will be the ones who secure for themselves future mission success. Your Royal Canadian Navy will be among this cohort.

This Digital Navy Initiative is intended to advance the innovation-related objectives laid out in Canada's defence policy, *Strong, Secure, Engaged* and the Royal Canadian Navy's *Strategic Plan 2017-2022*. It is a broad-ranging undertaking touching all parts of the naval enterprise, which will be guided by a distinctly people-centric approach. Our overarching aim is to leverage digital technologies in a way that augments our greatest strengths: our people, their knowledge and the sage judgement they apply to deliver and sustain a Navy in which all Canadians can be proud.

Successful execution of this initiative will require a fundamental cultural change within our Navy, one that instills innovative thinking and agility as the default settings for all members of the naval team. It will also require close and sustained collaboration with other government stakeholders, industry partners and academia in order to stay at the forefront of the many exciting opportunities made possible by rapid advances in modern digital technologies.

I am counting on every member of our naval team, regardless of rank or position, to proactively seek out and seize upon the opportunities that will be made possible throughout our digital journey. Working together, I am confident we will realize the vision laid out in this initiative and, in so doing, ensure that the Royal Canadian Navy is well positioned for success in the digital age.

Vice-Admiral Art McDonald
Commander Royal Canadian Navy
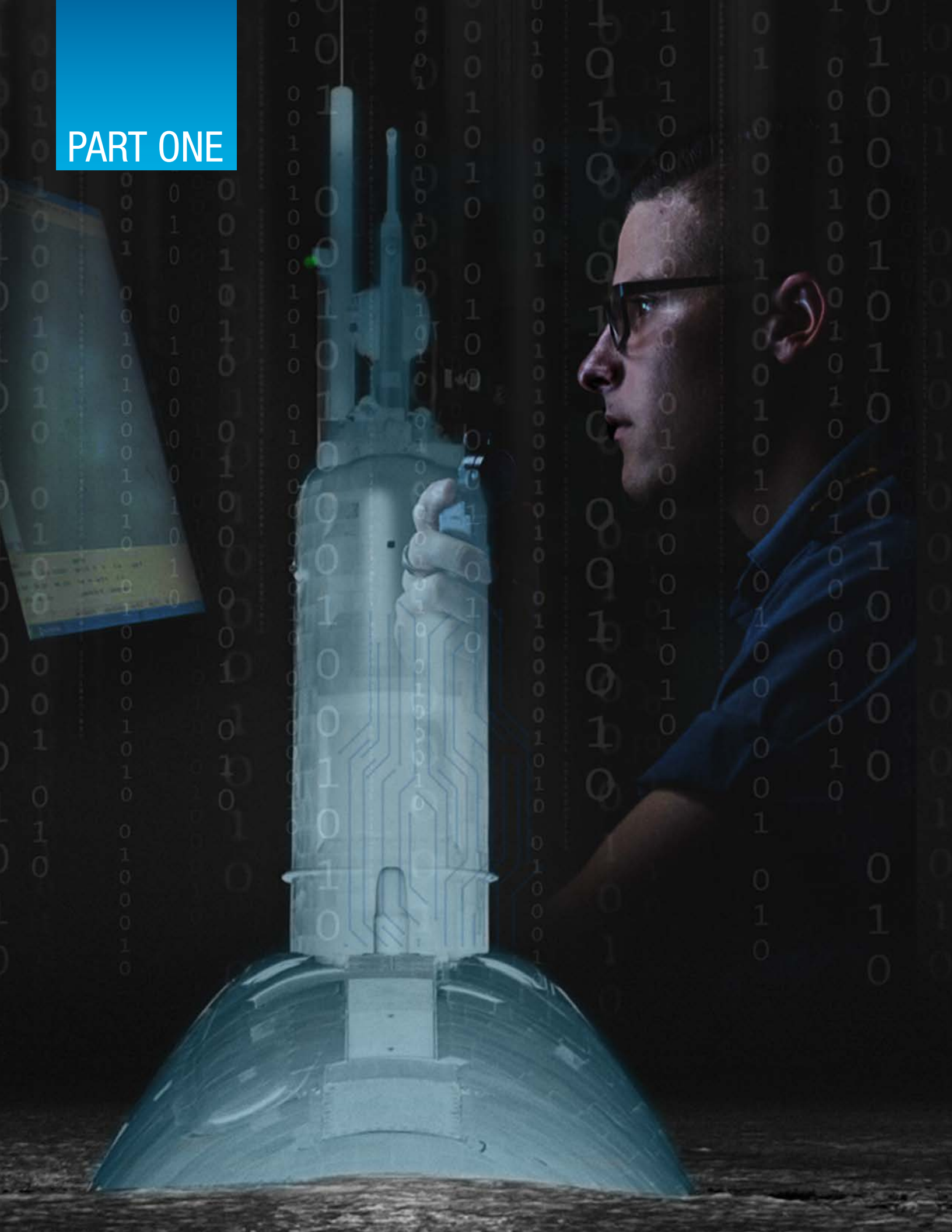
COMMANDER'S INTENT AND GUIDANCE

INTRODUCTION

Digital technologies have been generating immense opportunities for organizations in the public and private domains for decades and the Royal Canadian Navy (RCN) has a proud history of leveraging them to great effect. Whether it be pioneering efforts in the area of integrated shipboard machinery control and monitoring systems or the early adoption of network-based combat management systems, the RCN is no stranger to the utility and effective application of digital technologies.

Today, many innovators within the RCN are pursuing initiatives to capitalize on the vast potential made possible through modern digital technology. However, like many other organizations in and outside of government, the RCN finds itself increasingly challenged to keep pace with the accelerating rate of disruptive changes often brought about by the innovative applications in this area. It is for this reason that a more deliberate and focused approach is required to steer our Navy towards success in the digital era.

…the RCN, like many other organizations in recent years, has been challenged to keep pace with rapidly evolving digital technologies and the often disruptive effects they bring to bear.

Vice-Admiral Art McDonald – June 2019

Those organizations that manage to excel in this rapidly evolving digital environment are those that recognize that the challenge in keeping pace with the technological curve is as much about their people and organizational culture as it is about the technology itself. Our approach is guided by this understanding and will, therefore, place as much emphasis on driving the necessary cultural changes to spur innovation as it does on exploring specific technologies. Done correctly, our efforts will ensure the RCN remains a relevant and credible naval force, while reinforcing its proud reputation as a leader in the digital domain.

VISION

The RCN's digital evolution will be a journey spanning many years, one that will require the active and sustained engagement of all members of the naval team, regardless of rank or position. Throughout this journey, the RCN's core principle of *People First, Mission Always* will serve as a leadmark, reminding us that the best means to leverage technology is to do so in a way that augments and empowers our most important strengths: our people, their knowledge and the judgement they bring to bear.

Enabling Canada's Naval Team for the Digital Age - Digital Navy Mission Statement

We will build tomorrow's Navy around our team, inspiring them, their families and fellow Canadians with a digitally-enabled Navy that is always ready to defend Canadian interests at home and abroad. Our approach will draw on the insights of industry and academia, leveraging their experiences to deliver digital capabilities that augment and empower all members of the naval team. Our success will be aided by a journey of cultural transformation where creativity, innovation and change are the determinants of success on the path to establishing our organization as a truly digitally-enabled Navy.

SCOPE

This Digital Navy Initiative spans all elements of the naval enterprise, from the financial, business and human resource management functions that underpin the back-end of our business; to the engineering, logistics and training functions that directly drive readiness; to the warfighting function that is our raison d'être. It will also engage and touch upon all members of the naval team: our Regular and Reserve Force sailors, public servants, and industry partners.

A broad range of different digital technologies are treated under this initiative. This includes cognitive computing capabilities like artificial intelligence and machine learning that are driving advances in automation and big data analytics; cloud computing and mobile technologies that are transforming the ways that people and organizations access, store and manipulate data; and powerful digital tools like augmented and virtual reality systems, 3D printing and Digital Twin technologies that are opening up an exciting array of new opportunities across many domains. The specific digital technologies covered are treated in more detail within Part 2 of this document. In general terms however, if the truly innovative aspect of a given technology stems from the digital technologies contained therein, it will be considered within scope of this initiative.
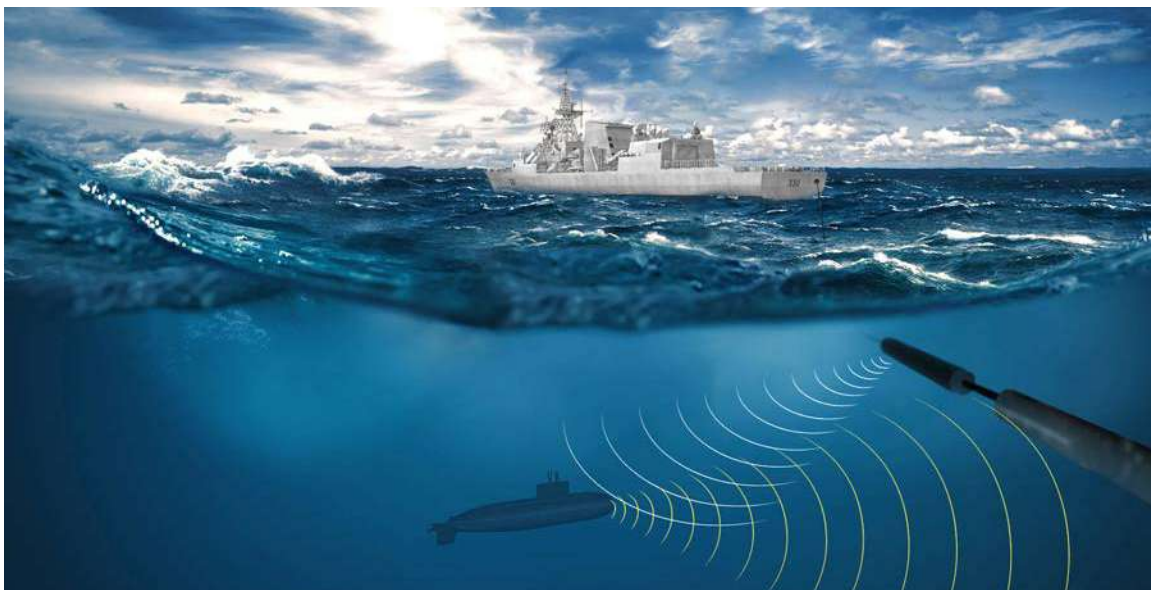
GOALS AND PRINCIPLES

Realization of our vision will require the innovative application of our collective imagination, openness to new ways of doing business and unwavering commitment to lean forward into the digital space. The goals we will use as leadmarks to guide our path to success and the underlying principles that will inform the approaches we employ are depicted in Figure 1.1 and explained below.

Fig. 1.1 Goals and Principles

GOALS

» EMPOWER THE RCN TEAM

This initiative seeks to empower and inspire all members of the naval team through the innovative use of leading-edge digital technologies, never forgetting that our most valuable strength stems from our people, their knowledge and the sage judgement they apply on a daily basis. We will, therefore, work to adopt those digital technologies that augment the irreplaceable capabilities of our people, ensuring they have the tools and capabilities needed to meet increasing challenges of the digital era.

» MAINTAIN AND DELIVER RELEVANT NAVAL FORCES

The rapidly evolving nature of digitally-enabled technologies provides great opportunities for those navies that proactively embrace them. Those navies that fail to do so expose themselves to threats with the potential to undermine their relevance in an abrupt and disruptive fashion. The overarching goal of this initiative is, therefore, to more deliberately and proactively embrace digital technologies in order to ensure the RCN's ability to deliver and maintain relevant naval forces that are, in all respects ready to answer the call.

» CREATE AN INNOVATIVE CULTURE

In order to get ahead of the digital curve, it is essential that the RCN find ways to innovate with more agility in the digital domain. This speaks to the need to evolve our processes in a way that facilitates more rapid transition from innovation to procurement without jeopardizing competition and fairness. It also speaks to the need to fundamentally evolve our culture towards one that is more collaborative, risk-tolerant and experimental.

PRINCIPLES

Forward-Looking Posture: In order to position ourselves to more proactively leverage modern digital technologies, we must adopt a persistent forward-looking posture. This includes establishing the capacity and expertise to identify those emerging digital technologies most likely to impact our way of doing business. It also requires that members of the naval team increase their awareness of modern digital technologies with a view to identifying opportunities that accelerate the RCN's evolution as a leading-edge institution.

Collaborative Outlook: Success in our digital journey will depend on the support and expertise of many strategic partners, including stakeholders inside the DND/CAF, other government departments, industry and academia. Our digital evolution will, therefore, be characterized by a collaborative approach that substantively engages our many partners on a sustained basis.

Security Compliant Evolution: Digital technologies create immense opportunities to enhance performance across all elements of the naval enterprise, but they also create potential avenues for adversaries to disrupt processes and data. To ensure the success of our digital evolution, we will afford top priority to security requirements, maintaining close collaboration with Departmental security authorities so that our efforts are not impeded by security threats.

Data-Centric Mindset: Reliable, quality data will be a fundamental enabler of this initiative. As such, our digital journey will require all members of the naval team to consistently place real emphasis on the production of accurate, reliable data and to continually look for ways to leverage this data to enable informed, forward-looking decisions. This data-centric mindset will be key to our success going forward.

Fundamentally, our decision to pursue this [Digital Navy] initiative is about people. It's about investing in and enabling our sailors to be at their best and to provide them with the satisfaction that comes from working in a world class, leading-edge institution.

Vice-Admiral Art McDonald – June 2019

Infrastructure-Oriented Thinking: The vast majority of digital innovations introduced through this initiative will require supporting digital infrastructure delivered and maintained by other Departmental Authorities. Close collaboration with these partner organizations will be crucial to our success and will require infrastructure-oriented thinking from the outset of our innovative initiatives.

Systems Approach: The broad-ranging impacts and interconnected dependencies associated with new digital technologies will demand a systems approach in all that we do. In practical terms, this will require early engagement and cross-functional collaboration with affected stakeholders, so that factors related to training, material support, interoperability, security and other domains are considered early in the development cycle.

WHAT SUCCESS WILL LOOK LIKE

At this point in our digital journey, the basic ingredients of success are known, but the specifics are less clear. As we learn about the vast potential of digital technologies through proactive, deliberate experimentation, our collective of understanding of what success looks like will become more detailed and nuanced. Notwithstanding this uncertainty, our success over the course of the next three years will include realization of the following outcomes:

- **An RCN recognized** for its leadership and proactive adoption of innovative digital technologies that empower members of the naval team;

- **Sailors digitally connected** through their personal mobile devices to cloud-based services and information that are currently only accessible from work;

- **Members of the naval team** with more time to devote to the creative aspects of their jobs thanks to the introduction of digital technologies that automate repetitive, rules-based processes;

- **Sailors freed** from the need to manually maintain the majority of paper-based logs at sea due to better use of digital recording tools and systems;

- **Members of the naval team empowered** by predictive maintenance capabilities made possible through edge-computing capabilities that facilitate local decision-making;

- **Sailors and civilian members** of the naval workforce empowered by the use of Digital Twins for specific platforms and systems that enable better in-service support across multiple domains;

- **Ships' companies more self-sufficient** while deployed due to sailors who are qualified to produce approved spare parts using shipboard 3D printing technologies;

- **An RCN better able** to rely on the quality of its data because of enhanced data governance and the use of digital technologies and practices that reduce data errors;

- **Functional Authorities better able** to make informed, data-driven decisions powered by advanced data analytics techniques, including artificial intelligence and machine learning;

- **Naval Staff better equipped** to optimize naval readiness across all domains through better integration and visibility of the data resident in siloed enterprise systems and tools;

- **A more risk-tolerant, experimental Navy** with the cultural mindset and competencies needed to actively drive digital innovations forward;

- **An RCN able to stay ahead** of the digital curve due to more streamlined processes and robust, ongoing collaboration with partners in government, industry and academia;

- **Naval leadership with a solid grip** on future digital technology and infrastructure requirements due to increased understanding of the opportunities and threats posed by emerging digital capabilities; and,

- **An RCN with solid plans and processes** in place to optimize the opportunities to introduce modern digital technologies into the HdW, JSS and CSC classes as they are being introduced into the fleet.

ACHIEVING THE VISION

Achieving our Digital Navy vision will require the sustained support of all members of the naval team over a period of years. Much of our effort at this early stage in our journey will be exploratory in nature and will be aimed at learning the true potential of digital technologies in a naval context. This exploration will largely be achieved through short-term pilot projects that will be iterative in nature and will, in some cases, prove unsuccessful. We will not be hindered by the prospect of failure in these pilot initiatives, so long as our occasional failures generate lessons that we embrace and build upon as we move forward.

This part of the document describes the digital journey that we have embarked upon and lays out the strategic objectives that will serve as our leadmarks. It provides a framework that illustrates those elements that will be key to our success and identifies the technological and organizational focus areas that will require our attention. It also includes the mandate for a new Digital Navy Office that will help to drive the program forward in a coherent manner in close collaboration with RCN Functional Authorities and outlines the approach that will be followed to facilitate communications.

DIGITAL JOURNEY

The digital journey that we have started will be a long-term undertaking that will play out over a multi-year timeframe. Executed effectively, our journey will serve to evolve the RCN to a more digitally mature organization. While much has been written about the attributes of digitally mature organizations, their success boils down to being able to make those changes that are needed to innovate more effectively and rapidly in the digital space. Those that succeed are the ones that recognize this challenge depends as much on their people and organizational culture as it does on the technology.

The generic trajectory towards digital maturity depicted in Figure 2.1 illustrates that the journey is one that progresses through several phases. In large organizations, it is common for different elements to be at varying levels of maturity and that is indeed the case for the RCN. This speaks to the need to improve information sharing and expertise across functional lines and to the need for sustained, deliberate focus on moving the organization up the digital curve. Our approach has been designed to meet these needs.

STRATEGIC OBJECTIVES

The RCN is committed to becoming a digitally mature organization through a people-centric approach that fosters an organizational culture which is more agile, risk tolerant and experimental. Six strategic objectives have been established in support of this overarching aim, all of which directly align with those objectives laid out in the RCN's *Strategic Plan 2017-2022*. The six strategic objectives along with their functional authority leads for the Digital Navy Initiative are as follows:

a. Deliver a digitally-enabled future fleet (Director General Future Ship Capability (DGFSC) and Director General of Naval Force Development (DGNFD));

b. Leverage digital technologies to attract and retain a motivated, technologically-oriented RCN workforce (Director General of Naval Strategic Readiness (DGNSR));

c. Increase the use of digital technologies to improve the delivery of materiel sustainability for the RCN (Director General of Maritime Equipment Program Management (DGMEPM) and DGNSR);

d. Further exploit digital technologies to improve the delivery of individual training and military personnel readiness (Assistant Chief of Naval Staff Personnel & Training (A/CNS P&T));

e. Increase the use of digital technologies to enhance the delivery of readiness and combat effectiveness (Assistance Chief of Naval Staff Afloat Training & Readiness (A/CNS AT&R)); and,

f. Advance business management and communication practices through the innovative use of digital technologies (Director of Naval Strategic Management (DNSM)).

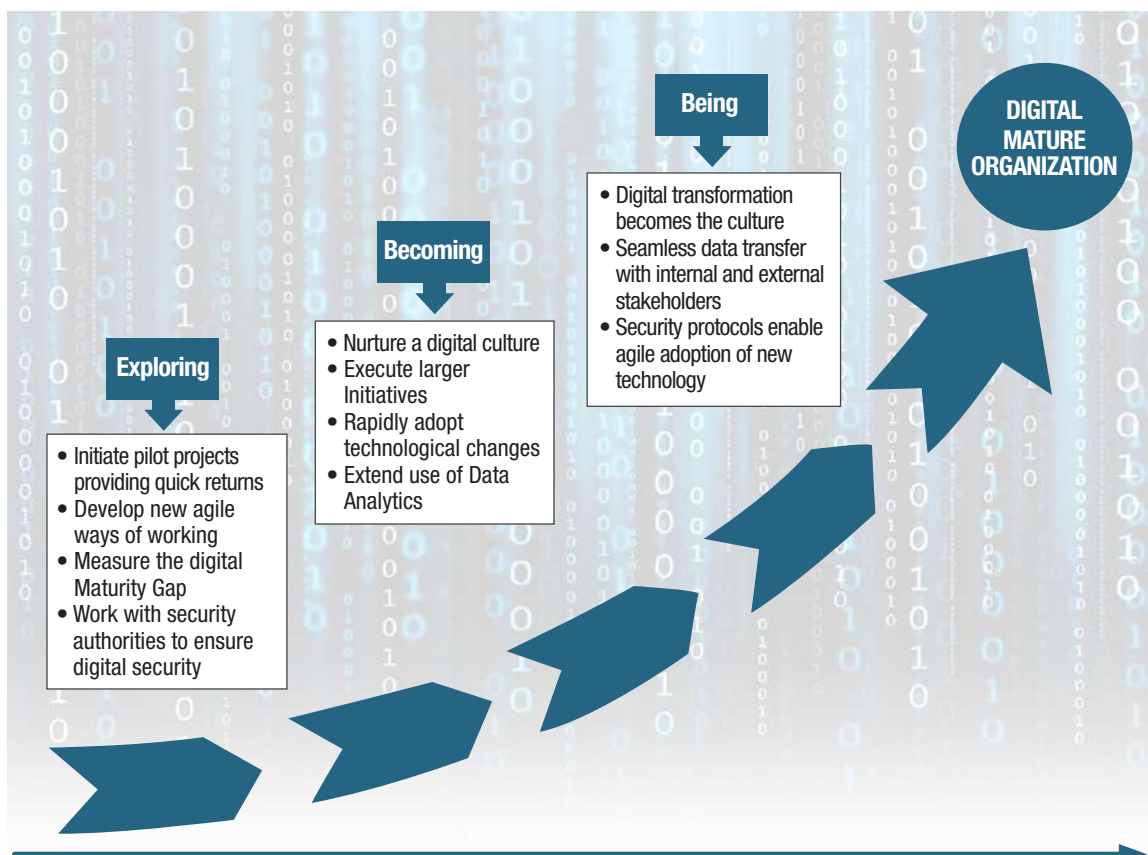Detailed initiatives supporting the strategic objectives will be published in the Digital Navy Action Plan.

Fig. 2.1 Phases of Digital Maturity

FRAMEWORK

The framework for the Digital Navy Initiative is depicted below in Figure 2.2. It is a broad framework spanning the entire RCN institution, which encompasses the core business functions (illustrated in blue) required to deliver and sustain a modern naval force. Technology focus areas (shown in green) are depicted as an inner layer within the framework to represent the critical role they will play in realizing the strategic objectives within the functional area of the naval enterprise. Data features prominently in the centre of the framework, representing the central role it will play in the success of our initiative by enabling informed, timely and evidence-based decision making. Security surrounds all the inner elements of the framework, emphasizing the principle that all aspects of the RCN's digital evolution will take into account security requirements and considerations.

The entire framework is surrounded by people, the RCN team. This initiative focuses on employing digital technologies to help people be ready to perform their jobs and to improve quality of life for all members of the naval team. To this extent, this initiative will ensure that the employment of digital technologies will not only empower members of the naval team but will increase their efficiency and effectiveness at sea and alongside.
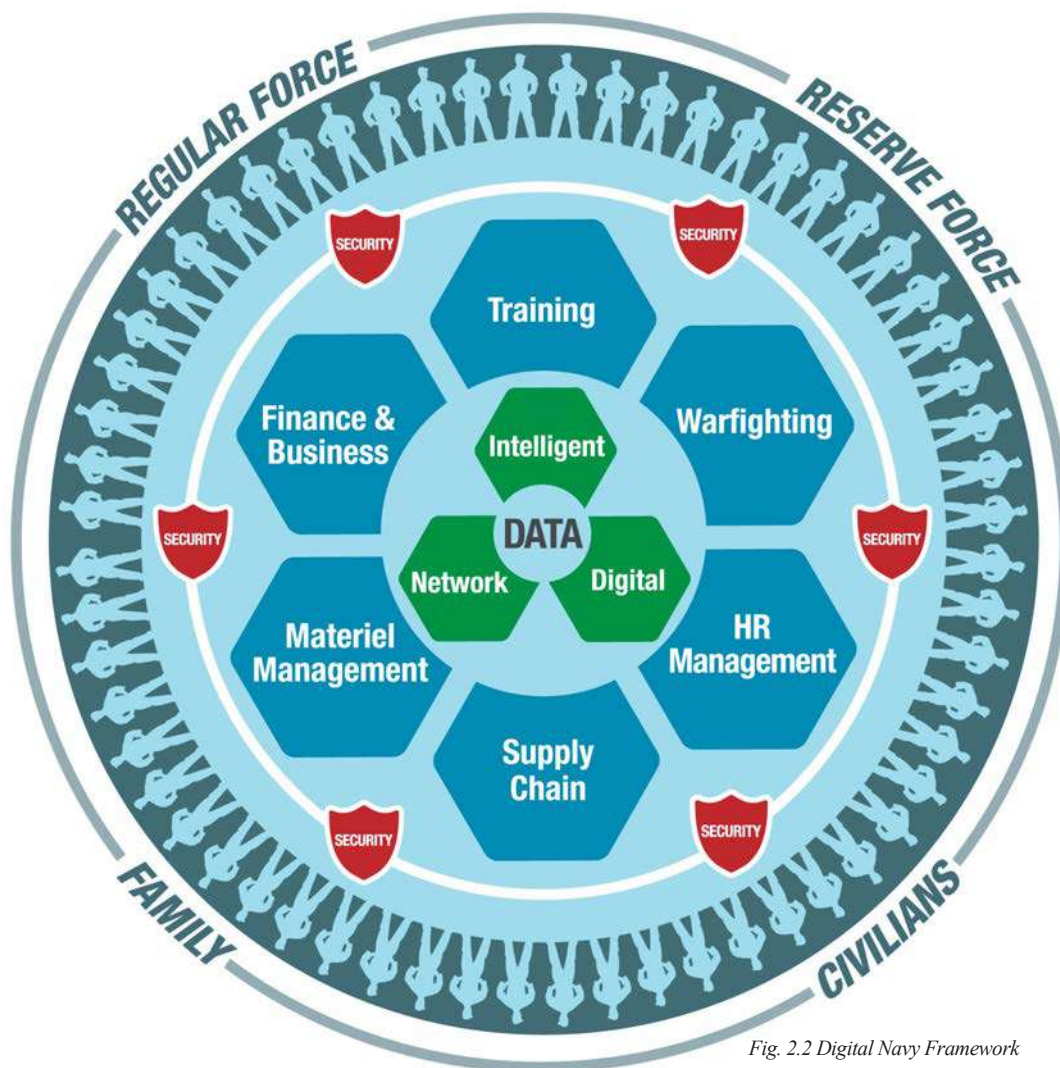

Fig. 2.2 Digital Navy Framework

DIGITAL NAVY INITIATIVE FOCUS AREAS

Execution of this initiative will enable the RCN to solidify itself as a mature digitally-enabled organization, one that empowers and inspires its people through the use of modern digital technologies. Initiatives pursued in support of the Digital Navy Initiative will centre on the inter-related focus areas depicted in Figure 2.3 and described below.

TECHNOLOGY-RELATED FOCUS AREAS

The digital technologies that will be explored during the initial phase of our digital journey have been organized into three broad categories depicted in the first three columns of Figure 2.3: Intelligent, Digital Tools, and Network. Explanations of these categories and the specific digital technologies contained therein are described below. This represents a snapshot of the digital technology types currently considered to be impactful for the RCN in the years ahead. As these technologies evolve and new ones emerge, so too will the technological areas that we choose to explore.
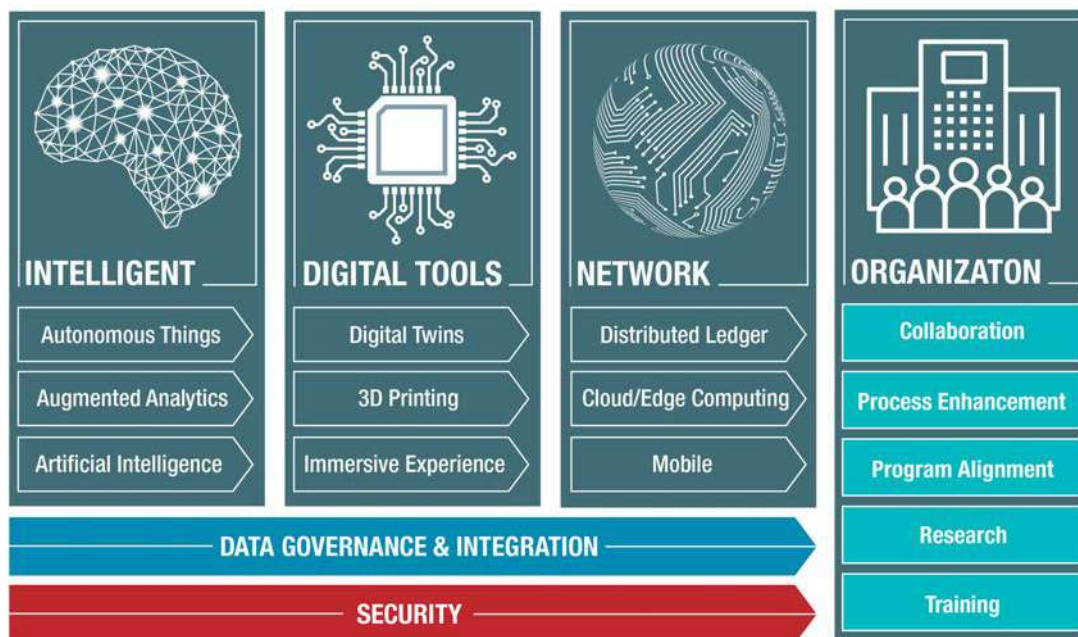

Fig. 2.3 Digital Navy Focus Areas

» **Intelligent**

The Intelligent focus area includes those technologies that are being driven by Artificial Intelligence (AI) with a particular emphasis on machine learning. These advanced capabilities are being introduced to an ever-increasing number of technologies and offer real potential for disruption across many domains. Specific technologies of interest in this category are detailed below.

• **Autonomous Things** includes a broad array of technologies including advanced robots, autonomous vehicles and intelligent agents ("bots"), which are rapidly evolving due to powerful cognitive computing capabilities like AI and machine learning. These technologies are of interest to the RCN as they have practical applications across the full spectrum of naval operations.

• **Augmented Analytics** involves the application of AI and machine learning to enhance the analysis of structured and unstructured data. The RCN has made significant progress in developing its data analytic capabilities over the past few years and will continue to do so by leveraging AI. This will be done with a view to fully exploiting our data to enable timelier and better informed decisions.

• **AI-Driven Development** refers to the use of AI in the engineering design process, whether that be for software, hardware or naval equipment and systems. This is an emerging application of AI that is of interest to the RCN as it has implications for naval materiel assurance, training provided to members of the naval team, and the tools that they use.

» Digital Tools

The Digital Tools focus area encompasses a wide range of digital capabilities that have the potential to empower and augment members of the naval team. It includes technology such as Digital Twins, 3D printers and Laser Additive Manufacturing that can improve the technical readiness of our naval platforms. It also includes Virtual Reality (VR), Mixed Reality (MR) and Augmented Reality (AR) technologies that can enhance training and assist members of the naval team in the performance of various tasks.

• **Digital Twins** are digital representations of real-world entities, which can include a specific piece of equipment, system or even an entire naval platform. The RCN is actively pursuing Digital Twin technologies because they incorporate real-time operating data from the physical device that offers the possibility of optimizing the operation and maintenance of naval systems. Digital Twins also have potential applications in other domains such as training, which makes this technology of particular interest to the RCN.


• **3D Printing** is a type of additive manufacturing that enables the creation of three-dimensional objects through the "printing" of successive layers of material. Laser Additive Manufacturing (LAM) is another additive manufacturing technique that achieves a similar end, only with metals. The RCN is actively pursuing both of these technologies as they offer the possibility of improving the availability of spare parts required for maintenance activities ashore and at sea.

• **Immersive Experience** technologies cover a wide range of evolving digital capabilities including AR, VR and MR devices. The RCN will explore these technologies because they can change the way that people perceive the real world and can be employed to augment training and enable maintenance and other activities to be completed faster, safer and more efficiently.

» Network

The *Network focus area* includes various digital technologies that make it possible to connect an expanding set of people and devices across networks. It encompasses cloud-based computing capabilities, the Internet of Things (IoT), powerful mobile devices and emerging blockchain technology that present exciting possibilities to improve the way that naval business is conducted.

• **Distributed Ledger** technology such as blockchain maintains a record of all transactions between users by employing markers to authenticate and validate transactions reliably and anonymously. The RCN is interested in this emerging technology area because it offers the potential to improve the management of the naval materiel supply chain activities.
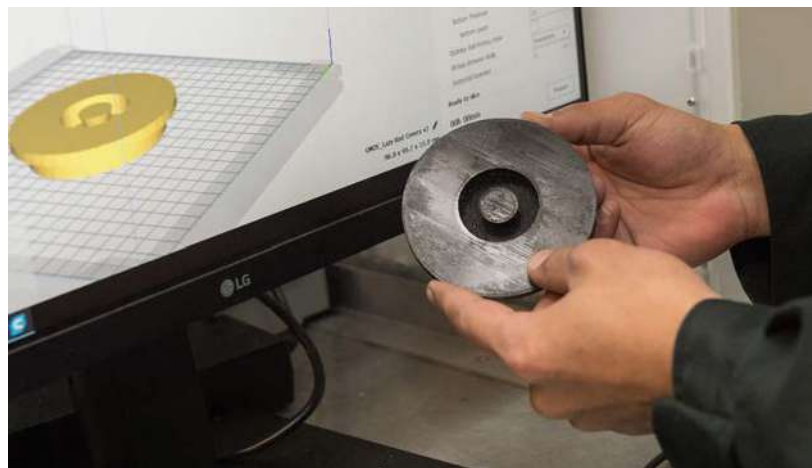
- **Cloud Computing** technologies refer to the on-demand availability of computer system resources that do not necessarily need to be owned or managed by the user organization. An array of services ranging from basic data storage through to on-demand software capabilities are offered by cloud service providers. Cloud technologies offer a number of potential benefits to the RCN, including the possibility of providing members of the naval team improved access to data and services that they are currently only able to access from work behind the DWAN firewall.

- **Mobile** technologies include smart phones, tablets and other portable devices that can be used to improve the connectivity sailors have with their families while deployed, or to augment the way that work is conducted at sea or ashore. Combined with the effective use of cloud-based computing capabilities, mobile devices offer significant potential to empower members of the naval team regardless of where they work. Many of the pilot projects pursued under the Digital Navy initiative will look to leverage the benefits of mobile devices.

DATA GOVERNANCE AND INTEGRATION

As data is central to the Digital Navy initiative, the Data Governance and Integration focus area spans all digital technology categories in Figure 2.3. It will leverage ongoing efforts to improve data quality so that naval data can be more fully exploited to drive timely, informed decision making. Efforts pursued under this focus area will also concentrate on better integrating data in stove-piped enterprise systems to better enable management functions across the naval enterprise.

SECURITY

The *Security focus area* is aimed at defending naval personnel, digital equipment and systems, and the sensitive data contained therein, from malicious or otherwise unauthorized activity. It entails close collaboration with Departmental security officials and includes activities that will be pursued under various cyber security strategies and initiatives.

ORGANIZATION-RELATED FOCUS AREA

The *Organization focus area* concentrates on efforts to make the RCN a more agile, innovative organization able to rapidly identify, assess and adopt advantage-conferring digital technologies. This will involve initiatives to improve business processes and instill a culture that is more risk-tolerant and experimental. It will also encourage the establishment of new collaborative, cross-functional networks to facilitate the exploration and introduction of emerging digital technologies, while driving more coherence in our digital efforts.

DIGITAL NAVY OFFICE

In order to ensure the successful execution of the RCN's digital journey, a Digital Navy Office will be established to facilitate the implementation and evolution of this initiative. The mandate of the Digital Navy Office will include the following core elements:

» **Program Alignment**

The Digital Navy Office will perform a coordination function to optimize synergies and collaboration amongst the stakeholders in order to bring coherence to the overall program. This will be achieved through close collaboration and sustained communication with the Functional Authority Digital Navy Champions and their supporting teams, Government of Canada stakeholders, and partners in industry and academia. To assist in this endeavour, Director Digital Navy will establish a collaborative ecosystem that will enable the necessary flow of ideas and coordination of effort. A component of this ecosystem will include a Digital Navy Forum that will draw key stakeholders together on an annual basis to exchange information and ideas that will be used to inform next steps on the RCN's digital journey.

» **Communications**

The Digital Navy Office will play a central role in ensuring that this digital initiative is well communicated to members of the naval team, Government of Canada stakeholders, and partners in industry and academia. This will include sharing stakeholders' best practices and expert advice to facilitate the RCN's digital maturation. To assist with communications, Director Digital Navy will develop and implement a communications plan, making full use of available venues and communications methods. A collaboration innovation platform will be included in the communication methods selected.

» **Performance Measurement**

RCN Functional Authorities will be responsible for implementing and reporting on the strategic objectives assigned to them in this initiative. To assist with this effort, Director Digital Navy will work with Digital Navy Champions to develop a performance measuring framework and associated metrics. Progress will be reported through the RCN Quarterly Report and via briefs that will be provided to Navy Governance on an as required basis.

» **Look-Ahead Function**

Director Digital Navy will put in place mechanisms to ensure the RCN has a continuous, forward-looking capability to identify new and emerging digital technologies that have the potential to be most impactful to the Navy in the future. This information will be used to guide decisions on which digital technologies the RCN will choose to examine under this initiative.

» **Process Enhancement**

Director Digital Navy will pursue efforts to enhance and, where necessary, develop processes to enable the RCN to more deftly identify, assess and implement innovative digital technologies. This will be critical to future success because many of the existing processes are not agile enough to keep pace with rapidly evolving digital technologies. As many of the applicable processes lie outside of RCN lines, these efforts will require sustained engagement with stakeholders in and outside of the department.

» Training

Working with the applicable training authorities, the Digital Navy Office will undertake efforts to provide training opportunities for members of the naval team aimed at increasing awareness of digital technologies and methodologies that will be used to examine them. These opportunities will be delivered through various means, including in-class and on-line coursing, workshops and seminars.

» Contract Vehicles

The Digital Navy Office will establish centrally managed contract vehicles to provide access to needed expertise and skill sets in the digital domain. Functional Authorities wishing to put in place contract vehicles to support their digital initiatives should first check with the Digital Navy Office to confirm if a centrally managed contract can be leveraged. In most cases, Functional Authorities wishing to access centrally managed contracts will be required to provide funding for the tasks undertaken.

COMMUNICATIONS

Regular and sustained communications within the naval enterprise and across government, industry and academia will be essential to the success of this initiative, as will the proactive engagement by all members of the naval team. To ensure communications are considered in a deliberate manner, a communications plan leveraging social media and cross-functional collaborative networks will be developed during the implementation phase. The communications plan will tie into existing governance to ensure that RCN leadership is kept apprised of the progress against the strategic objectives contained herein. To that end, progress reporting on the Digital Navy Initiative will be achieved through the RCN Quarterly Report and periodic briefs to the Naval Strategic Management Board and Naval Board.

DIGITAL NAVY ACTION PLAN

A Digital Navy Action Plan has been issued as a companion document to this guidance manual. It identifies the digital initiatives that will be undertaken by the RCN over the course of the next two years and provides more detail about how the Digital Navy program will be executed. Given the iterative nature of our digital evolution, the action plan will be updated and reissued on a regular basis in close consultation with stakeholders.

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