

# Advanced Manufacturing in Manitoba – An Investment Theme Paper for Progress

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## Introduction

Manitoba has a robust and diverse economy that has enabled this jurisdiction to weather and recover from economic challenges better than most. Manitoba's multi-sectoral manufacturing and services industries are underpinned by several large companies with truly international footprints. There are however, a number of significant external circumstances that must be addressed if Manitoba is to maintain and grow its economic base in terms of output, numbers of people in the work force, and the quality of the jobs in which they work. Manitoba industry's focus on near term economic viability, while important, tends to reduce the time and resources invested in preparing for, and capitalizing on, emerging processes, technologies and products.

There are a number of current opportunities in advanced manufacturing through which Manitoba can build on existing and nascent strengths to ensure that Manitoba's economy benefits from new manufacturing concepts and practices. Those opportunities include, but are not limited to, the National Research Council of Canada's (NRC) Advanced Manufacturing Program (formerly the NRC Factory of the Future (FotF) Flagship Program), and the Canadian Manufacturers and Exporter (CME) Canada Makes "National Additive Manufacturing Super Cluster" proposal, to name but two pan-Canadian initiatives. Additionally, there a number of related opportunities that could contribute to advanced manufacturing foundational activities. Those include a collection of Red River College advanced manufacturing applied research and educational initiatives, the University of Manitoba "Sensor for Advanced Manufacturing and Infrastructure" proposal, as well as upcoming and significant Industrial Technology Benefits investment opportunities arising from national procurements. Manitoba is one jurisdiction that is competing for resources that are available to other jurisdictions which are already devoting considerable time and effort to activities complementary to, and in support of the Canadian major investment programs mentioned above.

Manitoba's aerospace sector employs about 5200 people, the same number as 20 years prior. Sustaining employment, in spite of external forces and events is a significant accomplishment. The objectives must however, be to increase employment as well as the quality and economic output from this, and all of Manitoba's industrial sectors.

Manitoba needs to develop and implement a strategy that demonstrates to the world that it is focused on, and ready for an increasing role in the global advanced manufacturing value chain.

## Objectives

The objective of this document is to propose and develop themes through which Manitoba government, industry, and academic participants can coordinate and focus their advanced manufacturing efforts to achieve maximal economic impact. Implicit in this discussion is the

Manitoba needs to develop niche advanced manufacturing global value chain strengths in a focused, timely, and coordinated manner.

need to leverage Manitoba's efforts and resources invested with national advanced manufacturing initiatives. Additionally, value chain strengths must be developed that are complementary to, but not necessarily dependent on Manitoba's large enterprises.

## Advanced Manufacturing in Manitoba – Investment Themes Discussion

The following themes are proposed in an effort to focus efforts as well as ensure that the investment of time and resources most efficiently achieves the objectives sought:

- **NRC Advanced Manufacturing Program:** The originally named NRC Factory of the Future (FotF) NRC “Flagship Program”, now termed the NRC Advanced Manufacturing Program (AMP), was launched on 24 Nov 15 as part of a \$5.8B national infrastructure initiative. Although the NRC FotF/AMP was announced in 2015, discussions had been underway on an NRC Winnipeg initiative with Manitoba since late in 2011. The NRC AMP is pan-Canadian and multi-sector with four initial physical operational locations identified as Montreal, Ottawa, London, & Winnipeg. This initiative is planned to include an 80,000 sq ft, \$60M building in Winnipeg. Original NRC plans included approximately \$20M in government funding for operations over the first three years of the program at all locations. A Request-For-Offer (RFO) for 6.5-10.5 acres of serviced land in Winnipeg was issued on 24 April 2017 with building occupancy slated for late-2019/early-2020. When this initiative was re-branded the AMP, program personnel were directed to engage in local consultation sessions of which the last of a number of sessions will be held in Winnipeg on 13 June 2017. Manitoba needs to present a unified and coherent approach to NRC, without which its benefits potential to Manitoba may not be maximized. A coordination effort is required to ensure that the Manitoba NRC operation is attuned to Manitoba’s longer term cross-sectoral industrial goals and objectives.

*It is proposed that a mechanism be established to assist in the generation and coordination of Manitoba input to the NRC AMP in advance of the June 13<sup>th</sup> NRC consultation session in Manitoba. Consistent themes cutting across key sectors need to be communicated if NRC is to be able to develop a Manitoba AMP operation that achieves maximal impact in a timely fashion. Additional detail on this proposal is included in Annex A to this document.*

- **Quick-starting Manitoba advanced manufacturing:** During mid to late 2016, Manitoba competed for, and won a GE Aviation/Unison Industries competitive process for a “brilliant factory” that would be designing and manufacturing a significant new product line for aero-engine components in Winnipeg. Unfortunately, GE Aviation decided at the last minute not to pursue this initiative for what were cited to be “external circumstances. While the manufacturing opportunity did not proceed, it did further raise awareness of the economic potential for new-to-Manitoba advanced manufacturing operations, and did result in the formulation of some concepts for quick starting an advanced manufacturing initiative. This “interim” factory of the future activity, as it was then termed, was envisaged to consist of a developmental automated manufacturing module around which supply chain operations were to be established and integrated. This approach enabled a sub-scale “fail fast” type environment for concurrent development and integration of the broader AM supply chain operation within the interim facility. It is proposed that a similar technology demonstration approach be pursued as part of this initiative.

A public-private partnership similar to existing industrial campuses could be used to quick start advanced manufacturing activities in a collaborative virtual environment, as a stand-alone activity or in concert with other national initiatives.

*It is proposed that an interim factory of the future technology demonstration environment be established in Manitoba. Ideally, this environment would be in conjunction with one or more of the other themes noted in this document, although it could also be a stand-alone virtual network of existing and new resources. The decision could be made for this investment as a*

*quick start activity that would serve to better define market drivers and opportunities. Additional detail on this proposal is included in Annex B to this document.*

- **Additive Manufacturing:** There are a number of additive manufacturing initiatives that could be addressed beginning with the following:

- **Additive manufacturing (AM) gap analysis:** While advanced manufacturing goes far beyond the demanding requirements of metals additive manufacturing, Manitoba already possesses a recognized capability in additive metals manufacturing. Recent opportunities that could not be pursued for a number of reasons have highlighted some gaps in local Manitoba capabilities. Addressing these gaps does not represent an inordinate investment, and if addressed, could serve as a rapid means of becoming more prominent and visible in the global additive manufacturing community. In essence, an initial gaps analysis has been undertaken through these missed opportunities which range from Design-For-Additive Manufacturing (DFAM) competencies, through process qualification accuracy computer tomography (CT) non-destructive inspection (NDI), to production accuracy CT-NDI, to print chamber sizing and materials capabilities, to post processing requirements including Hot Isostatic Pressing (HIP'ing). While a more comprehensive gap analysis is required, one that for example, addresses non-metallic 3-d printing, a quick-hit list already exists for a nearer term metals AM gap closure process in Manitoba.

Metallic AM market demand is far in excess of existing capacity. This is an ideal market entry stage for Manitoba that can build on nascent Manitoba AM capabilities.

*It is proposed that a core, immediate capacity and capability metal additive manufacturing gap analysis be conducted and costed such that ways and means of addressing these gaps can be defined for near term redress. This gap analysis would ideally dovetail with both national initiatives described herein, providing focused and coordinated input to participation in these initiatives and enabling leveraging of Manitoba investments. Additional detail on this concept is included in Annex C to this document.*

- **CME Canada Makes Additive Manufacturing Super Cluster Proposal:** It is understood that CME is proposing an Additive Manufacturing Super Cluster to the Federal Government's 2017 Budget announcement of \$950M for super cluster investment to implement Canada's Artificial Intelligence (AI) innovation agenda. Up to this point in time, the CME activity has focused on Ontario and Quebec where significant investments are already being made by provincial governments and industry. The activity is cross-sectoral, addressing aerospace, medical, industrial automotive, marine and energy sector additive manufacturing market requirements. This initiative is a virtual network built around a central cluster for each economic sector identified above, with satellite clusters established as public-private-partnerships. The organizational construct fits well with Manitoba's collaborative industrial environment, and existing industrial campus arrangements between Red River College, Magellan and StandardAero. It is proposed that an advanced manufacturing industrial campus be considered under this initiative and possibly as part of the quick start advanced manufacturing theme introduced below.

*It is proposed that Manitoba pursue direct involvement in the CME initiative in order to position Manitoba as an integral component of the national and global value chain. This activity will engage a broader collaborative network and enable the leveraging of Federal funds to achieve local AM objectives. Additional detail on this proposal is included in Annex D to this document.*

- **Advanced manufacturing human resource development:** Factories of the Future will incorporate an increasing mix of cyber and physical resources working side by side. Factories will be self-diagnostic/self-correcting, and capable of efficiently changing components produced as well as being capable of producing large and small batch sizes in a seamless and cost effective manner. While there will be fewer human workers in these factories their skills requirements will typically be much higher and the work environments more challenging and rewarding. For the most part, curricula are not now available for many of the specific skill sets required for advanced manufacturing human capital development. Human resource development will be critical to establishing Manitoba as an Advanced Manufacturing value chain source.

*It is proposed that a Bachelor of Technology in Advanced Manufacturing and Materials be developed at Red River College as that educational institution is already making significant investments in advanced manufacturing programs. Red River College also supports two industrial campus arrangements that could serve as a template for an advanced manufacturing industrial campus. Additional detail on this proposal is included in Annex E to this document.*

## Summary

The best way to get something done is to begin.

Advanced manufacturing has been a priority topic in Manitoba for several years. Government, industry and academia understand the opportunities deriving from the introduction of advanced manufacturing operations and the need for development of a supply chain approach to this pre-eminent market opportunity. Likewise, it is recognized that gaps exist in local capacities and capabilities that need to be addressed, both in the near and longer terms. Other jurisdictions have developed and are implementing strategic plans for advanced manufacturing constructs. Manitoba has an opportunity to build on its past research into advanced manufacturing, the lessons already being learned in other jurisdictions, and, to leverage Manitoba's investment in its advanced manufacturing industrial and academic base.

Action is now necessary to bring industry, government and academia together in a consolidated, coherent, and success focused strategic framework that create new employment opportunities and economic strength in highly rewarding work environments. An investment theme proposal summary table is provided on the following page.

<b>Manitoba Advanced Manufacturing Investment Themes Working Table</b>				
<b>Initiative</b>	<b>Proposal</b>	<b>Proposal team</b>	<b>Cost Estimate</b>	<b>Comments</b>
<b><i>NRC Advanced Manufacturing Program</i></b>	Coordinate Manitoba input to the NRC Advanced Manufacturing Program (AMP) in advance of the June 13th NRC consultation session in Manitoba.	Lead:		The timing of the June 13 <sup>th</sup> consultation session requires that this be addressed immediately.
<b><i>Quick-starting Manitoba Advanced Manufacturing</i></b>	Establish an interim factory of the future technology demonstration environment in Manitoba.	Lead:		As a stand-alone or as part of an existing industrial campus. Could be linked to CME or NRC initiatives.
<b><i>Additive manufacturing (AM) gap analysis</i></b>	Perform a Metal additive manufacturing gap analysis and costing as the initial step in a broader AM gap analysis.	Lead: Precision ADM		This would form the core of a broader gap analysis, but would be used to develop concepts and process.
<b><i>CME Canada Makes Additive Manufacturing Super Cluster Proposal</i></b>	Pursue direct involvement in the CME initiative in order to position Manitoba as an integral component of the national and global value chain.	Lead:		A May 31 <sup>st</sup> , 2017 Canada Makes event entitled "Taking the Lead in Additive Manufacturing" in Boucherville Quebec is an ideal information gathering opportunity.
<b><i>Advanced Manufacturing Human Resource Development</i></b>	Develop a Bachelor of Technology in Advanced Manufacturing and Materials Program	Lead: Red River College		Initial step proposed, but further development of short courses, research requirements etc is necessary.

**Annex X:**

**Investment Theme:**

**Concept:**

**Proposal Team:**

**Action Plan:**

**Timing:**

**Investment Cost:**

**Risks:**