Overview of CARIC

Strategic Workshop

National Network for Innovative Shipbuilding/Marine Research and Training

St. John's, NL

26 September 2016

CARIC:
Consortium for **A**erospace
Research an **I**nnovation in **C**anada

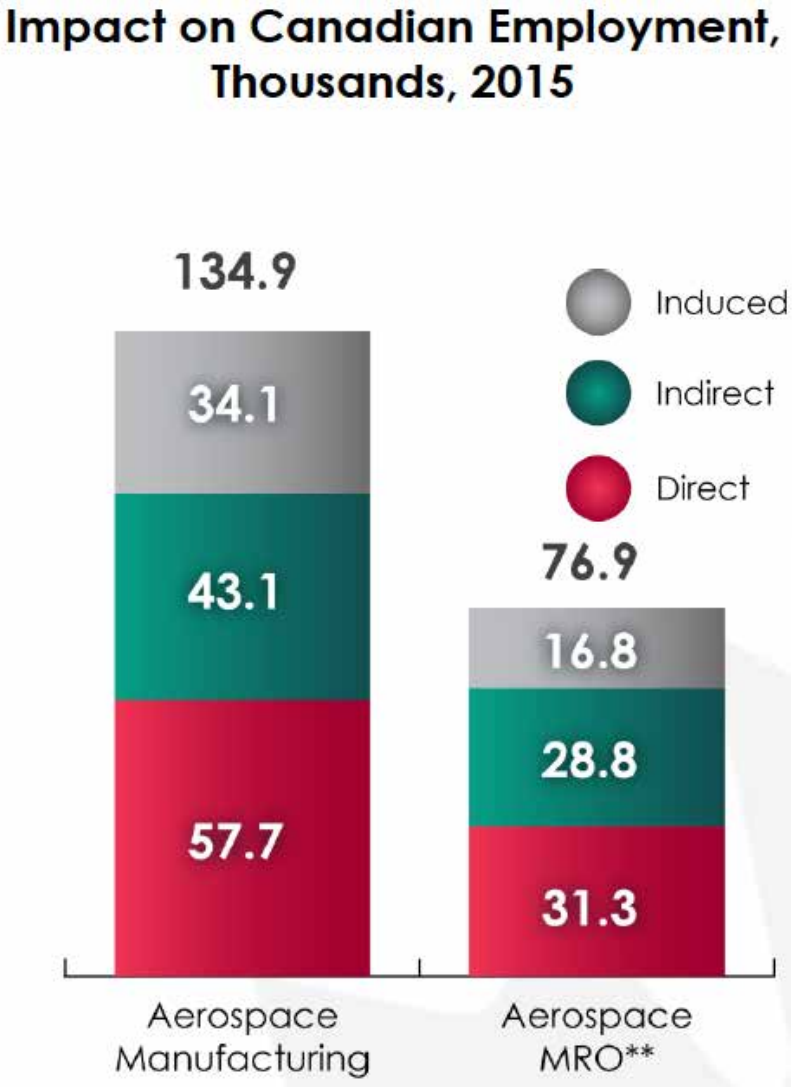
A National Collaboration Initiative for the Canadian Aerospace Industry

Outline

- Canada's aerospace ecosystem
- Origins of CARIC
- Mission, Vision & Values
- Membership
- Governance
- Finances
- Projects
  - Themes
  - Technology Readiness Level (TRL)
  - Project types
  - Canada-EU Collaboration
- Publicity
- Lessons for iSMART

Canada's Aerospace Ecosystem

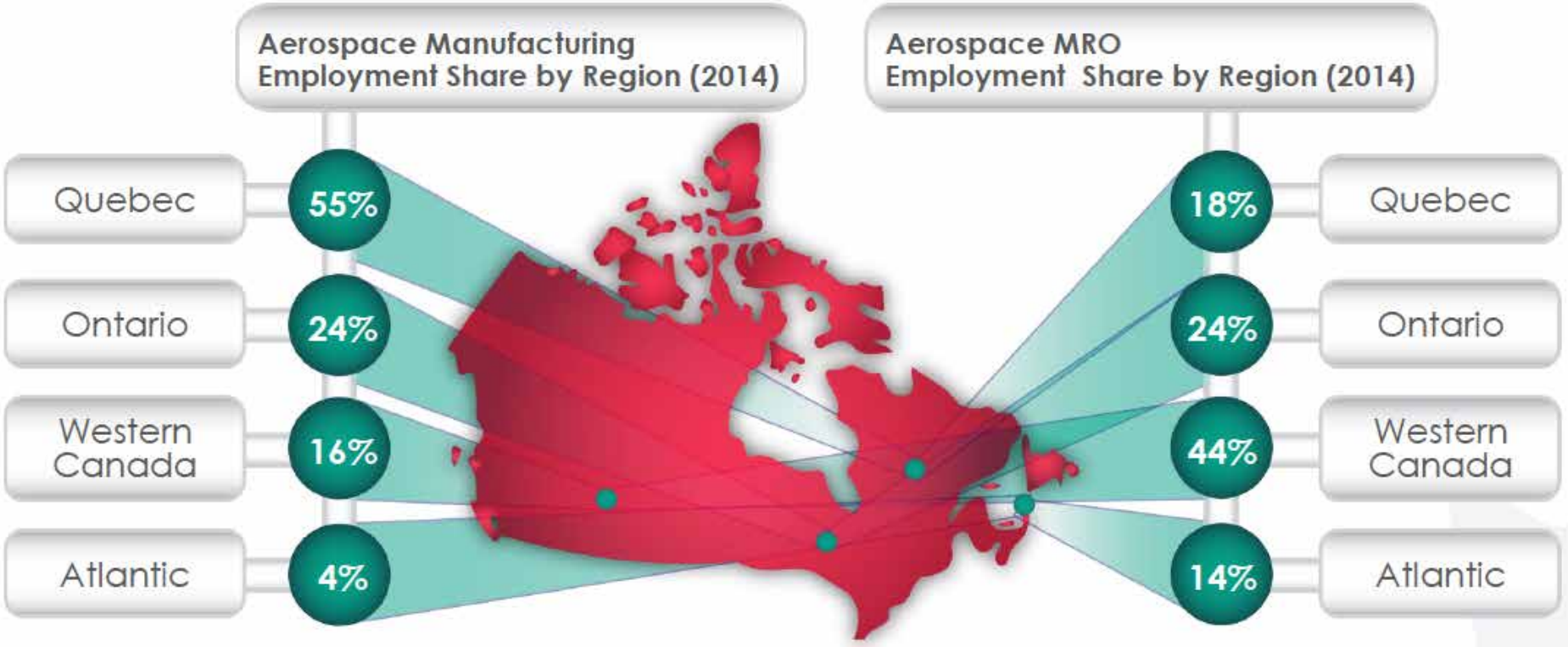
- 5th largest aerospace industry in the world
- The aerospace industry generated in 2015:
  - $29.8B in revenues
  - $13.3B in direct GDP
  - 89,000 in direct employment
- High commitment to R&D
  - Aerospace – 30% of R&D of total manufacturing sector
  - R&D expenditure in 2015 was $1.9B
  - This is 5 times the average for Canada's manufacturing sector



Source: State of Canada's Aerospace Industry: 2016 Report, ISED & AIAC, 2016

Canada's Aerospace Ecosystem

- Aerospace is a national industry



Source: State of Canada's Aerospace Industry: 2016 Report, ISED & AIAC, 2016

Canada's Aerospace Ecosystem

- Interests of Canada's aerospace industries represented by very active trade associations, principally
- Aerospace Industries Association of Canada (AIAC)
  - Active for >50 years
  - Membership >150
  - AIAC Pacific

- Committees
  - Civil Aviation
  - Public Procurement and Defence
  - Labour Market
  - Small Business
  - Market Access
  - Space
  - Supply Chain
  - Technology & Innovation
  - International Exhibitions Committee (Non-Technical Committee)

Canada's Aerospace Ecosystem

- Several provincial trade associations (or similar) members of AIAC:
  - Aéro Montréal
  - Aerospace and Defence Association of PEI (ADAPEI)
  - Aerospace and Defence Industries Association of Nova Scotia (ADIANS)
  - Aviation Alberta Association
  - CRIAQ-Consortium for Research and Innovation in Aerospace in Québec
  - Manitoba Aerospace Association Inc.
  - National Research Council of Canada
  - New Brunswick Aerospace and Defence Association
  - Ontario Aerospace Council
  - Saskatchewan Ministry of the Economy
  - The Aerospace and Defence Industry Association of Newfoundland and Labrador (ADIANL)

CARIC
- Origins

- CARIC was launched in April 2014 with the financial support of Innovation, Science and Economic Development Canada (ISED)
- A joint initiative of
  - AIAC (Aerospace Industries Association of Canada)
  - CRIAQ (Consortium for Research and Innovation in Aerospace in Québec)
- CARIC is modeled on CRIAQ and managed by it
- CRIAQ
  - Started operation in 2002
  - Has 55+ industry and 25+ academic members

CARIC
- Mission & Vision

- Mission
  - *Generate and foster dialogue and collaboration between players in the aerospace industry.*
  - *Provide financial support to launch R&D projects in partnership with these players.*
- Vision
  - *Strategic, financial and administrative support encourages the industry and research community to work together to achieve excellence and compete on a global scale.*
  - *CARIC, provincial associations and member need to collaborate to give the aerospace industry a regional reputation, a strong Canada-wide presence and international market prominence*

CARIC
- Values

- **Collaboration:** *Collaboration drives the research projects funded by CARIC — industry and research community collaboration, provincial association collaboration, intersectoral and transdisciplinary collaboration, SMB and industrial group collaboration, sometimes even international collaboration.*
- **Innovation:** *CARIC is an organization acts as a catalyst of innovation — its members strive to push boundaries and shape the future of aerospace research, development and technology adaptation.*
- **Creativity:** *Creativity is vital to innovation. CARIC's synergistic approach galvanizes this creativity to overcome industry-specific technical challenges and develop advanced, market-oriented solutions.*
- **Credibility:** *The Canadian aerospace industry has an excellent international reputation as a leader. And CARIC brings together — through its board, committees and membership — experts from the sector and research community and a diversity of industry players that associate their credibility with CARIC.*
- **Agility***:* *Tuned to the needs of a rapidly evolving industry, CARIC must be agile, both regulatory and technologically, when it comes to its procedures, methods and decisions.*
- **Result-oriented:** *CARIC is a results-driven organization with an avowed mission to make tangible contributions to the aerospace industry.*

Membership

- Membership of CARIC is varied
  - Type of organization
  - Size of organization
- Six membership categories:
  - Original Equipment Manufacturers (OEMs)
  - Intermediate Companies
  - Small and Medium Enterprises (SMEs)
  - Universities & Colleges
  - Research Organizations
  - Associated Members

Membership

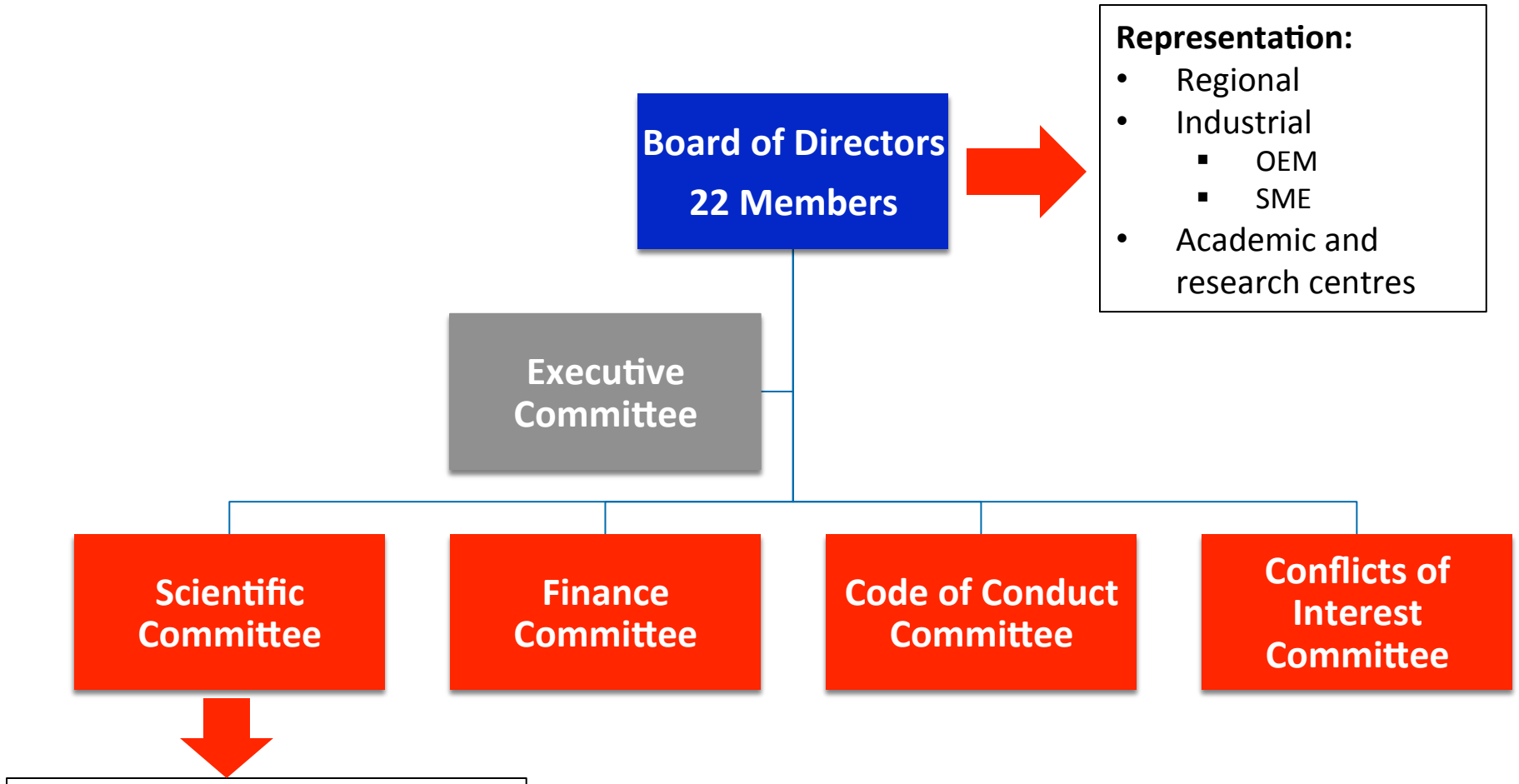
- Original Equipment Manufacturers (OEMs) 4
  - Large companies in which aerospace is either a major activity or the only activity

- Intermediate Companies 10
  - A mix of large companies in which aerospace is part of their business activity and smaller organizations where aerospace is their primary business


Membership

- Small and Medium Enterprises (SMEs) 58
  - A range of smaller companies mostly service providers to aerospace
- Universities & Colleges 29
  - Virtually all Canadian universities and colleges with aerospace or allied programs are members.
- Research Organizations 6
  - Mostly government research agencies and quasi-government organizations
- Associated Members 5
  - Mostly trade associations

Governance



Source: Modified from Ontario Centres of Excellence presentation, undated

Governance

- The work of CARIC is managed and administered by a team comprising full-time and part-time members:
  - President & CEO
  - VP, Business Development & International / Regional Director – Québec
  - Director of Communications
  - National Director
  - Several other Directors:
    - Regional Directors – Ontario, Central, Pacific, Atlantic
    - Administration & Program Support
    - Programs
- Administrative staff – 6 full-time (?)
- CARIC headquarters are in Montréal, QC

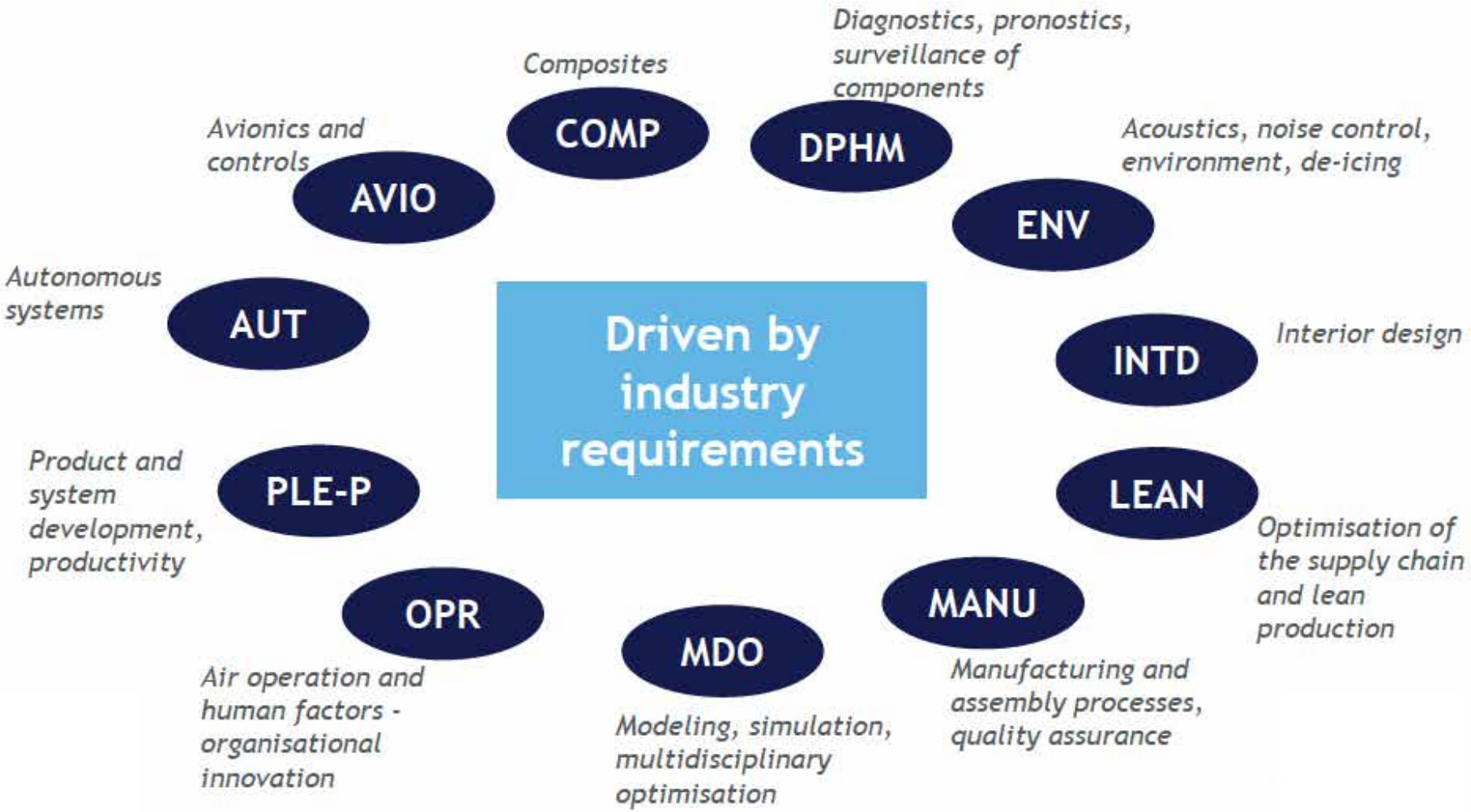
Finances

- CARIC operations and funding for projects is financed by:
  - Membership fees
  - In-kind contributions
  - Government
    - NSERC
    - ISED
    - Provincial
- CARIC applies a project funding scheme depending on the maturity of the technology being developed
  - Technology Readiness Level (TRL)

Projects

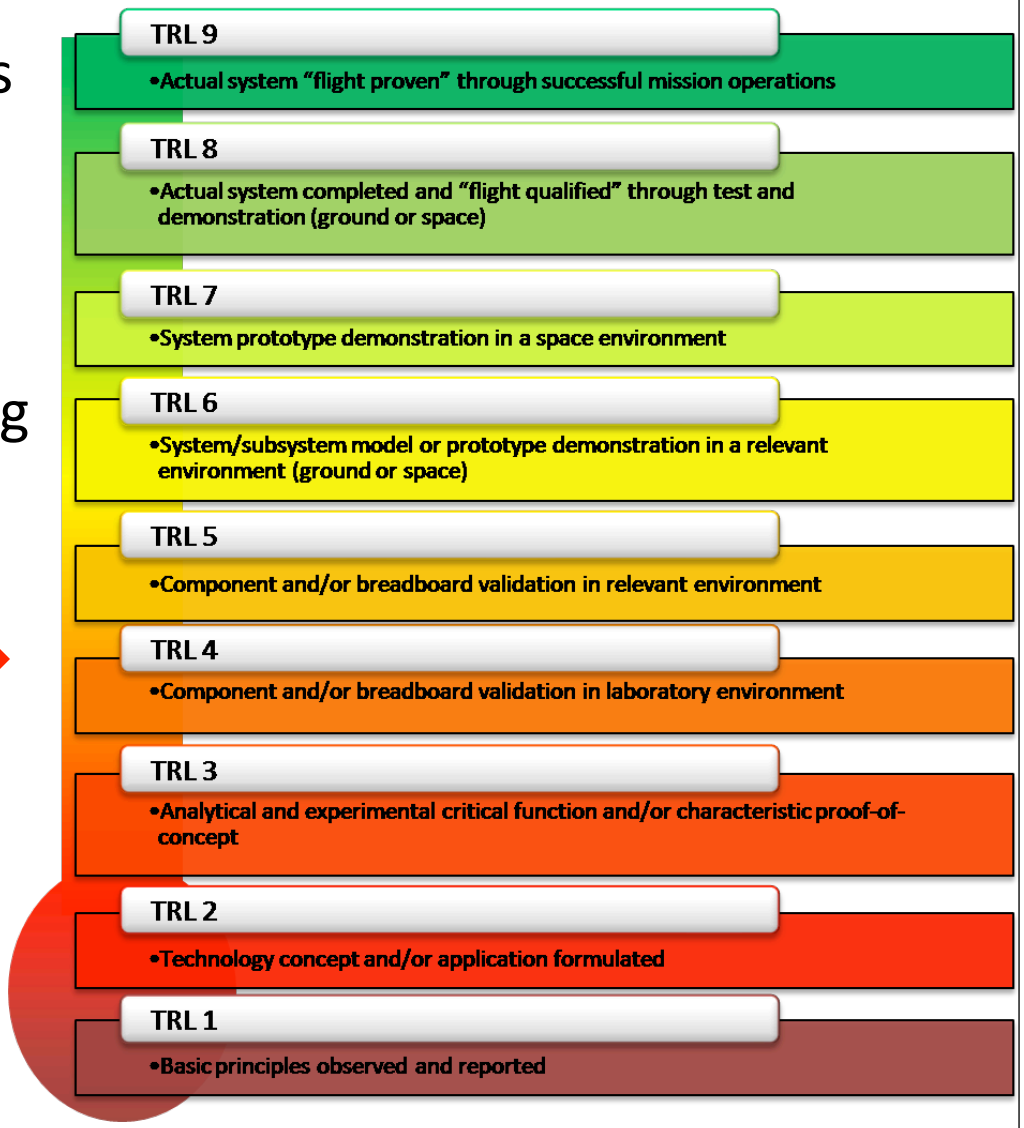
- CARIC projects typically fit in 11 subject areas
  - Technology
  - Production
  - Operations
- CARIC uses the Technology Readiness Level (TRL) in categorizing projects
  - Some differences in project management practice and funding depending on TRL
  - Two broad categories of TRL are used

Research Themes



Technology Readiness Level (TRL)

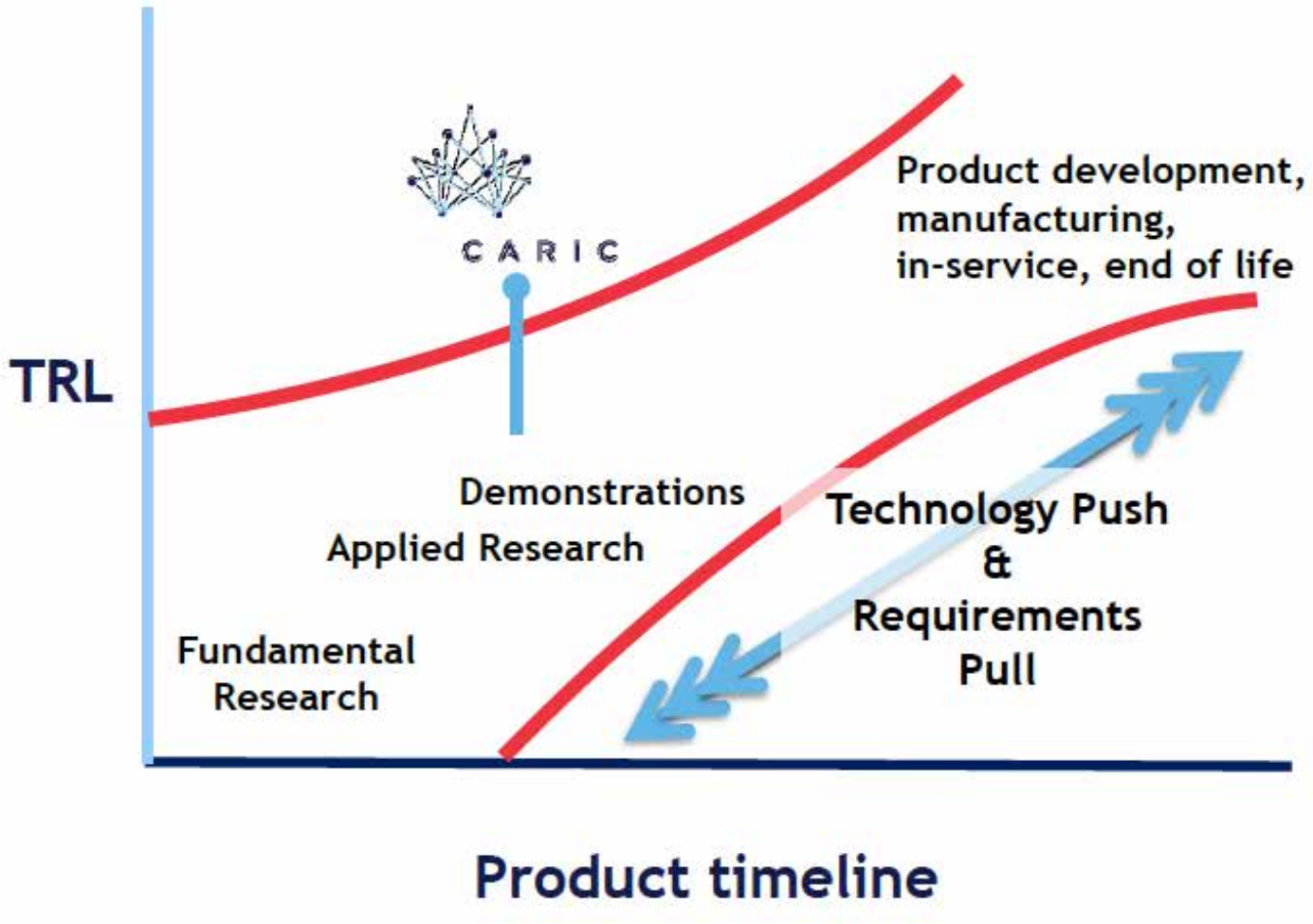
- The TRL Number characterizes the maturity of a particular technology
- A common measure of TRL is expressed as a number ranging from 1 to 9
- NASA developed one of the first. Current NASA TRL scheme
- CARIC employs a similar methodology



Source: NASA

Technology Readiness Level (TRL)

- CARIC uses TRL to categorize potential projects



Projects

- Basic types of projects

Programs	Exploring Technology	Maturing Technology	Aero Connect
Primary objectives	Exploring the potential of emerging technology to generate new applications ideas through applied research projects	Validating or demonstrating key technology components in a significant component environment	
TRL	1-4	4-6	1-4
Typical length	3 years	1-3 years	~ 6 months
Type of partnership	Minimum of 4 Canadian partners: • 2 industry partners (OEMs or SMEs) • 2 academic and/or research centre	Minimum of 4 Canadian partners: • 2 industry partners (OEMs or SMEs) • 2 academic and/or research centre	Minimum of 2 Canadian partners: • 1 industry partner • 1 academic partner

continued …

Projects

- Basic types of projects

Programs	Exploring Technology	Maturing Technology	Aero Connect
Basic financial contribution from industrial partners	25%	25%	$0
Funding recipients	• Academic and/or research centres	• Industry partners • Academic and/or research centres	• Academic and/or research centres
Intellectual property	Generic CARIC project agreement (mandatory)	Generic agreement template supplied by CARIC upon request. Negotiation of clauses on IP at the discretion of partners	Agreement at the discretion of the partners

Typical Project

Project title

Research theme

TRL No.

+ Diagnostic and Prognostic system for aircraft systems

PROJECT TYPE
Maturing Technology

PROJECT STATUS
In progress

PROJECT DURATION
2 years

START DATE
2015

DPHM-702_TRL4+

The reduction of aircraft life-cycle cost and the reduction of environmental footprint of aerospace industry trigger innovative ideas not only at design level but also at maintenance level. Operators are looking for highly reliable equipment, nevertheless when a failure occurs, they want to be able to identify and replace as quickly as feasible the faulty unit. Operators are looking for user-friendly tools to reduce time dedicated to maintenance on their fleet.

An effective aircraft health management integrates all system components into a monitoring strategy consisting in diagnosis and prognosis technologies that addresses failure mode mitigation and life cycle costs. While current signal processing and experienced-based approaches to
effective in many aircraft applications, knowledge
can provide further improvements and are not ne
develop or maintain. Using these new technologi
detection accuracy associated with the capability

Basic project parameters

Project partners

this highly efficient aircraft product would lead to increase manufacturing activities in Canada and a more favorable trade balance to exports.

Industrial leader

THALES

Academic leader

Université Concordia University

Financial partners

CARIC

International Collaboration

- CARIC, together with NSERC, and working with several EU countries initiated three joint projects:
  - Additive Manufacturing Optimization and Simulation Platform for repairing and re-manufacturing of aerospace components – AMOS
  - Electromagnetic Platform for lightweight Integration/Installation of electrical systems in Composite Electrical Aircraft – EPICEA
  - Super-IcePhobic Surfaces to Prevent Ice Formation on Aircraft – PHOBIC2ICE

Public Relations

- Research Forums are periodically held:
  - Unrestricted attendance
  - Opportunity to hear of local aerospace industry's R&D needs
  - Chance to air potential R&D projects
- Trade shows
  - Recent examples
    - "R&D Connector" held at DEFSEC Atlantic, the Canadian Defence Security and Aerospace Exhibition Atlantic show, 6 Sep 2016
    - CARIC attended Farnborough Air Show 2016
      - Discussions about collaborative Canada-UK aerospace research

Concluding Remarks & Lessons for iSMART

- CARIC is an excellent example of collaborative engineering research and development
  - Inclusive
  - Industry-driven
  - Outward looking
- Support from all sectors:
  - Industry
  - Government
  - Academia
- Success partly due to well-developed procedures derived from CRIAQ which has been in operation since 2002