

***CRIAQ - a unique model for collaborative,
industry led research, involving Industry,
universities and research centres***



Consortium de recherche et d'innovation en aérospatiale au Québec
Consortium for Research and Innovation in Aerospace in Québec



Photos : courtoisie de Bell Helicopter Textron Inc., Bombardier Inc., CAE Inc., Pratt & Whitney Canada Corp.

Mission

- Increase competitiveness of Aerospace Industry and enhance collective knowledge base through a better training of students
- **OBJECTIVES**
 - Collaborative Research Projects (distinct projects, industry driven, multiple partners)
 - Innovation (Full IP coverage)
 - Training (Students in every project)
 - Promotion (support student forums and competitions)
 - National Collaborations (non-Québec Universities, GARDN, Ecological Airplane) international (missions, exchanges, projects)

Members /
Industries
(46)



Members /
Universities and
Research Centres
(19)



Associate
Members
(9)



Non-Québec
Universities
(11)



Partners
(4)



Research Forums

A Special Synergy



Forum Date	3 rd Forum 2006-03-06	4 th Forum 2008-04-17	5 th Forum 2010-04-08
Participants (industrial included)	225 (90)	290 (100)	395 (142)
Projects	14 new projects	34 new projects	48 potential projects

Research Themes

DPHM

Diagnostics, Prognostics, Health Monitoring
7 projects

COMP

Composites
24 projects

ENV

Icing, Safety, Environment
13 projects

MDO

*Modeling, Simulation, Optimization,
System Integration*
17 projects

ACOU

Vibro-Acoustics and Noise Control
6 projects

AVIO

Avionics and Control
18 projects

LEAN

Supply Chain Optimization and Lean
5 projects

PLM

*Product Life Cycle
Management*
3 projects

INTD

Interior Design
2 projects

AUT

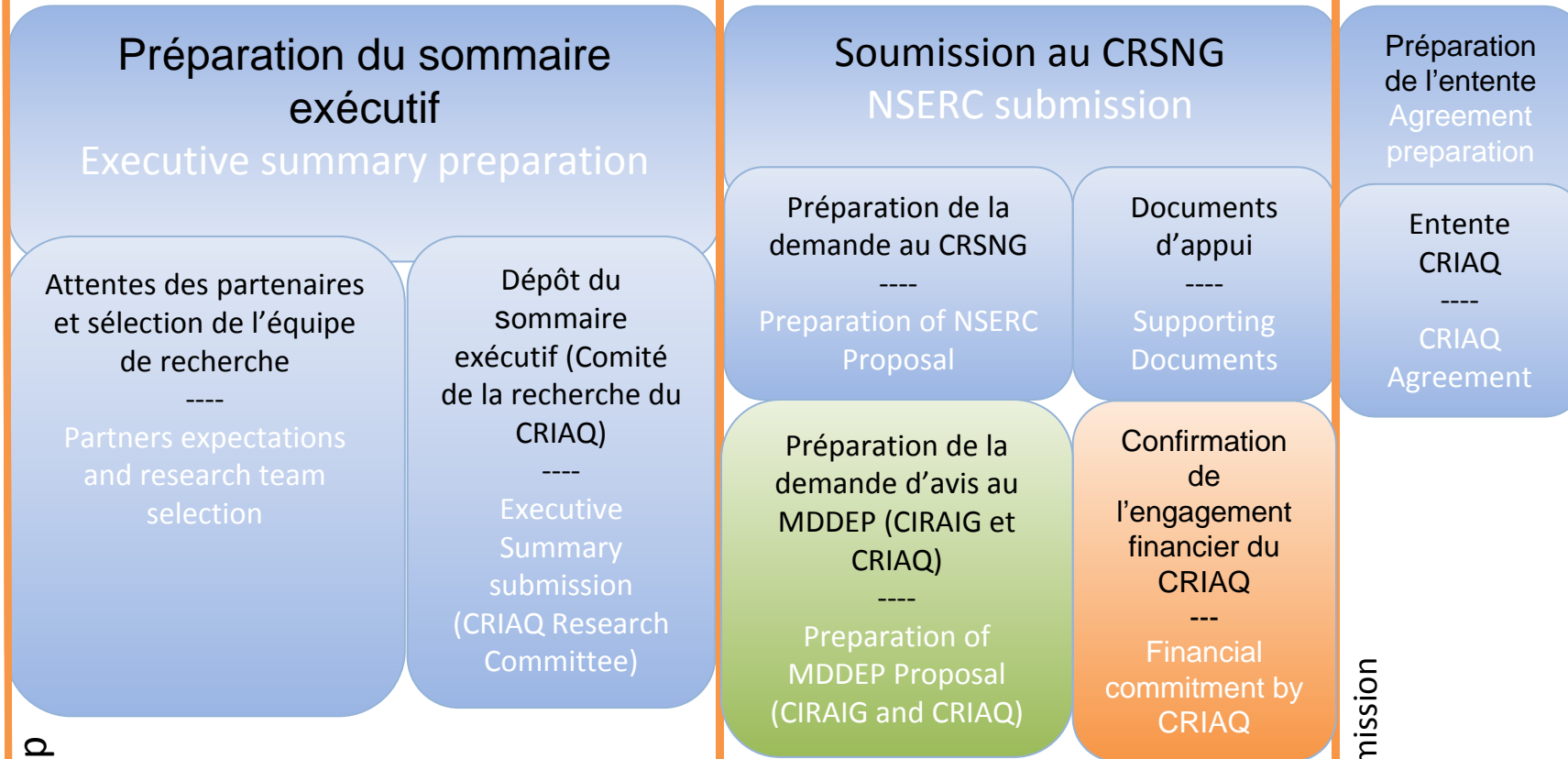
*Autonomous
Systems
New*

MANU

Manufacturing
27 projects

Étapes de démarrage de projets

Project launch process



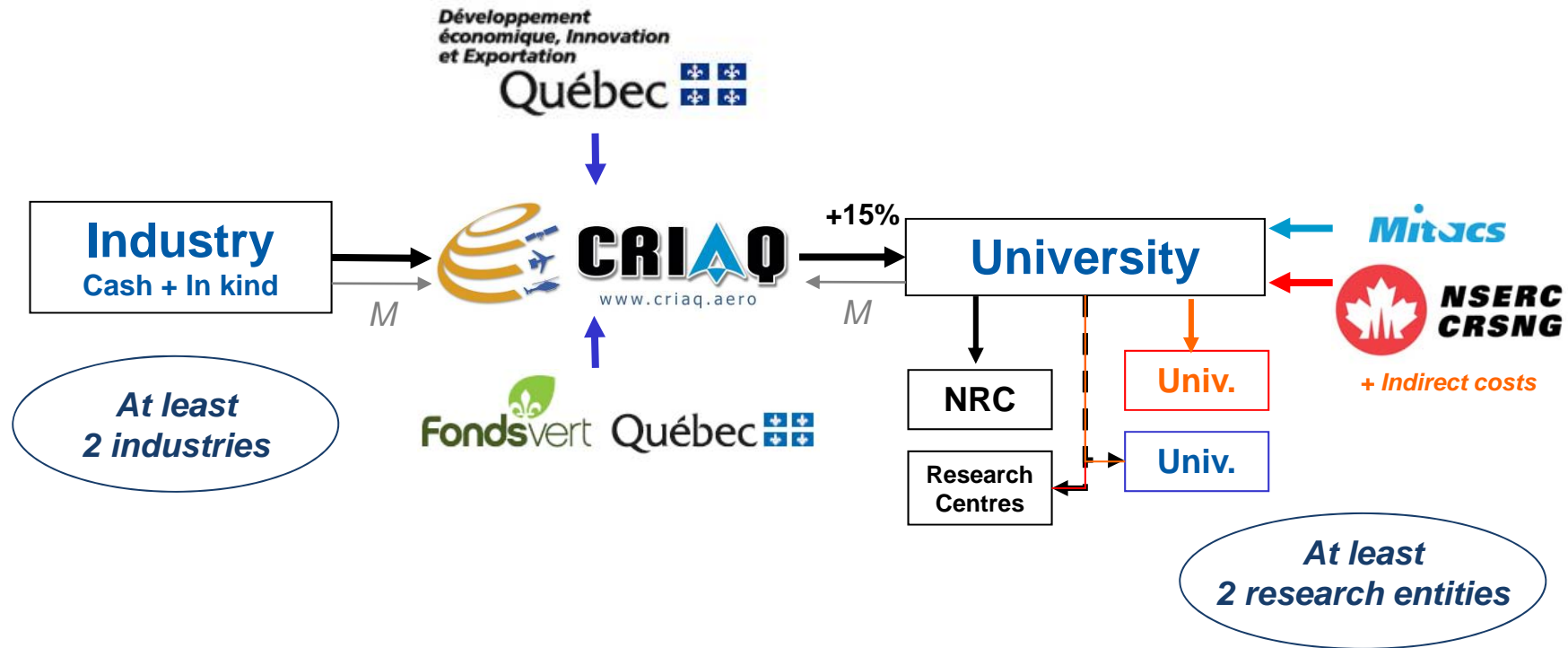
Atelier
Workshop

Recommandation
du CRIAQ
CRIAQ
recommendation

Dépôt de la
demande
Application submission

Signature

Project Financing CRIAQ I projects



M ... Membership fees



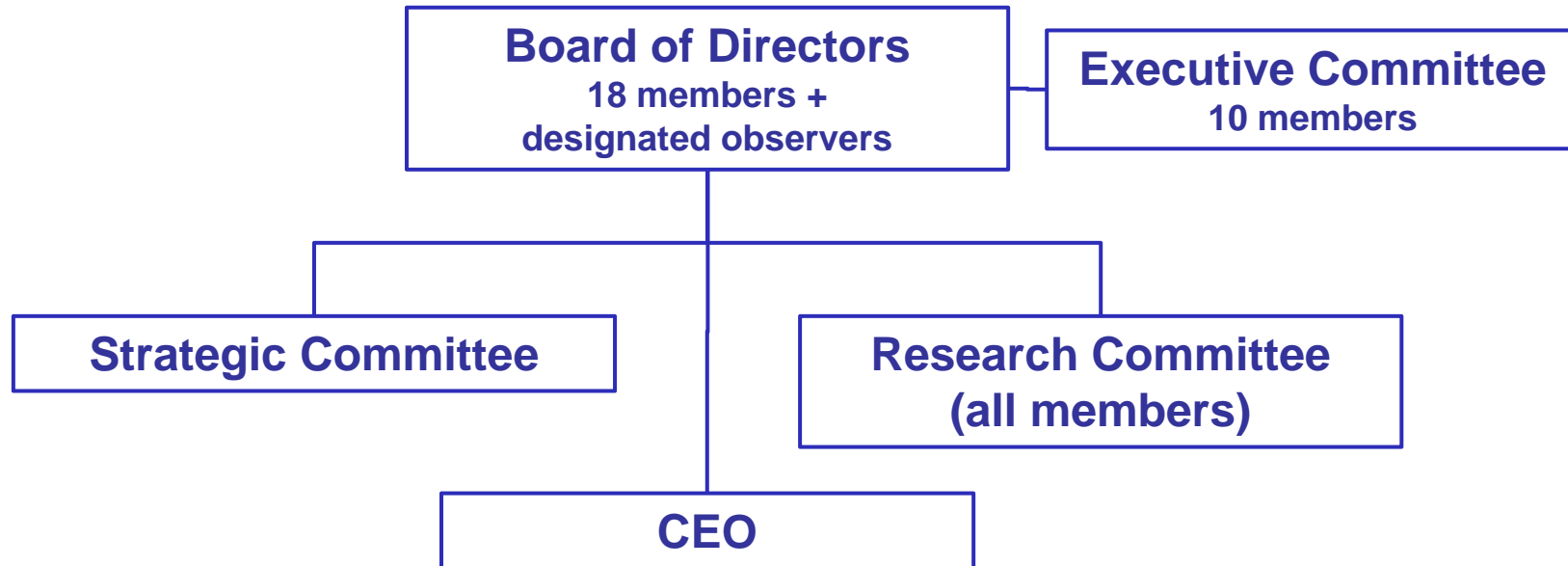
Intellectual Property

- **Background IP remains the property of its original owner**
 - A royalty free license to Background IP is granted (i) for use during the Project and (ii) if required to exploit Foreground IP.
 - Royalties may be payable if the Background IP is identified in a Schedule to the Project Agreement and a basis for the payment of royalties is agreed upon.
- **Foreground IP owned by Project Partners**
 - whose researchers have had a substantive creative, inventive or intellectual contribution to its generation.

Intellectual Property (2)

- **Licensing :**
 - Industrial Project Partners obtain an exclusive world-wide royalty-free license for aerospace applications in their respective defined field of interest (with right to sublicense to affiliated companies) on any Project Foreground IP owned by University Partners or NRC (similar scheme applies to Joint Intellectual Property);
 - specific benefits sharing or financial compensation may be addressed to in a Schedule to the Project Agreement.
 - Use in teaching and academic research is guaranteed.
- **Publication:**
 - Subject to certain limitations concerning inventions and confidential information, publication rights are guaranteed to all Project Partners (maximum delay 6 months).

CRIAQ Governance



Typical CRIAQ project

Out of Autoclave Composite Aerospace Structures Manufacturing

Industrial Partners

BOMBARDIER

Bell Helicopter
A Textron Company



Financial Partners



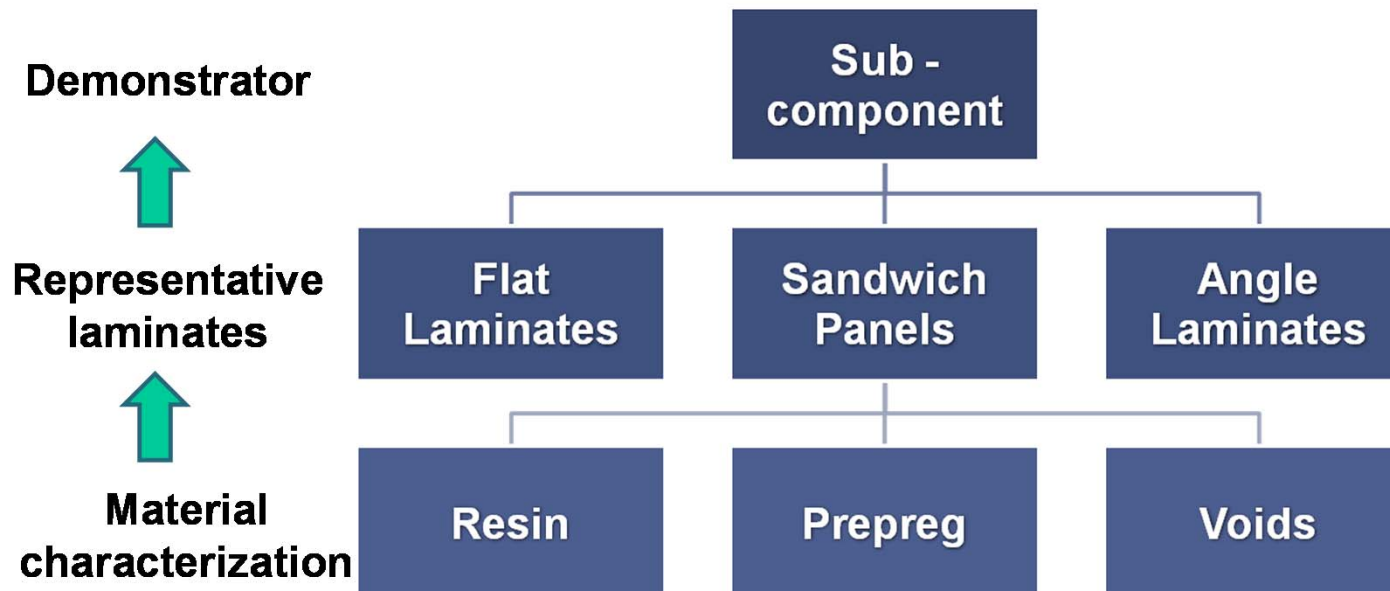
Research Units



Objectives

- Investigate the relationship between the performance and the production costs associated with the manufacturing of a composite airframe structure using out-of-autoclave prepreg technologies

Approach

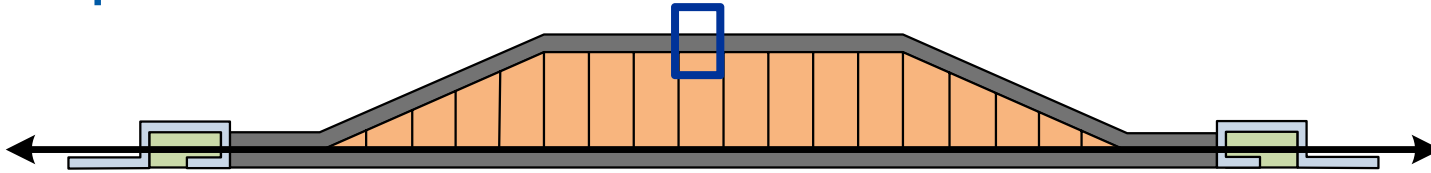


Budget (3 years)

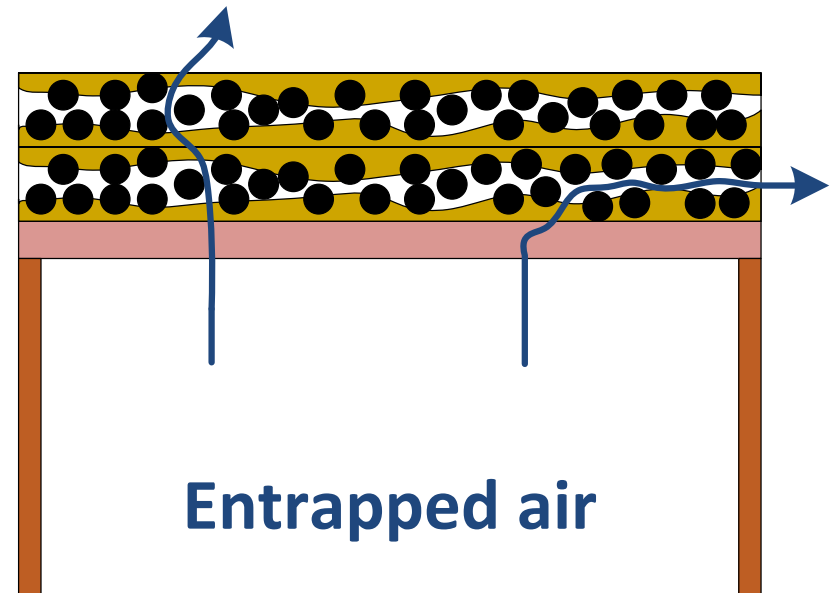
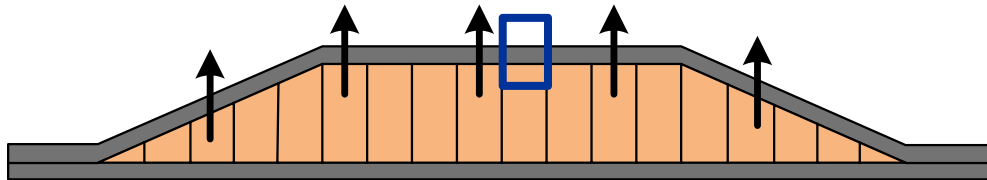
Sources of funding (cash)		
	Cash	Total
Industrial Partner 1		\$ 75,000
Industrial Partner 2		\$ 90,000
SME		\$ 30,000
NSERC		\$390,000
CRIAQ (direct)		\$135,000
CRIAQ (overhead)		\$ 49,500
In-kind contributions		
Ind. Partner 1 (materials, salaries)		\$ 75,000
Ind. Partner 2 (materials, salaries)		\$ 90,000
SME (salaries)		\$ 30,000
CRIAQ (salaries)		\$ 15,000
Grand Total		\$979,500

Air Evacuation Strategies

In-plane



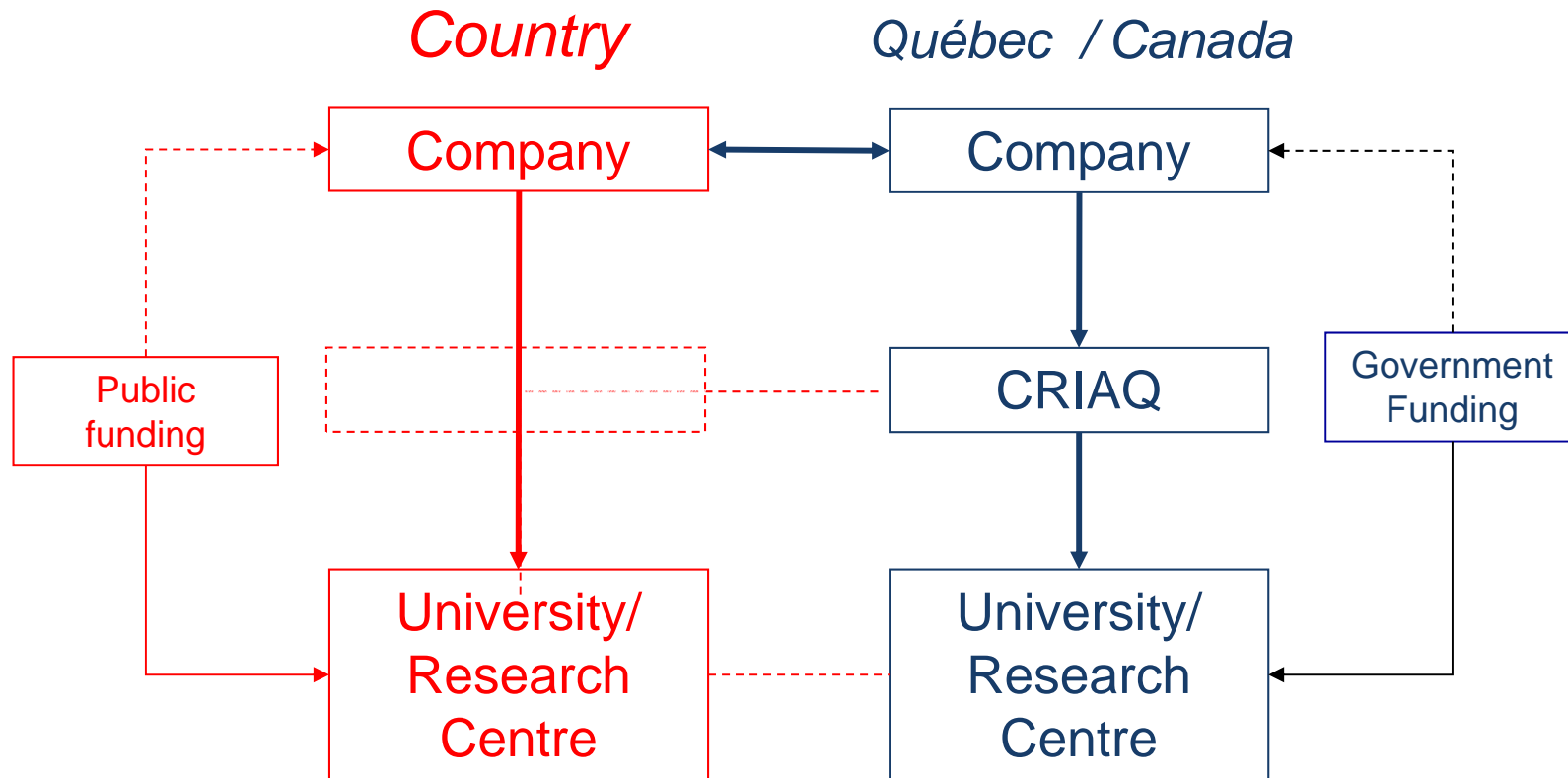
Through-thickness



Project Impact

- **Frequent exchanges with researchers**
 - Quarterly progress meetings
 - HQP training : In progress (3 PhD, 4 MEng),
Completed (3 MEng, 4 UG, 1 PDF)
 - Prof. sabbatical leave at Ind. partner (9 months)
- **Direct technological transfer to active industrial programs**
- **Financial leverage**
 - 8 to 1 on overall project
 - \$75 000 investment of one partner leads to \$1,000,000 project with related IP

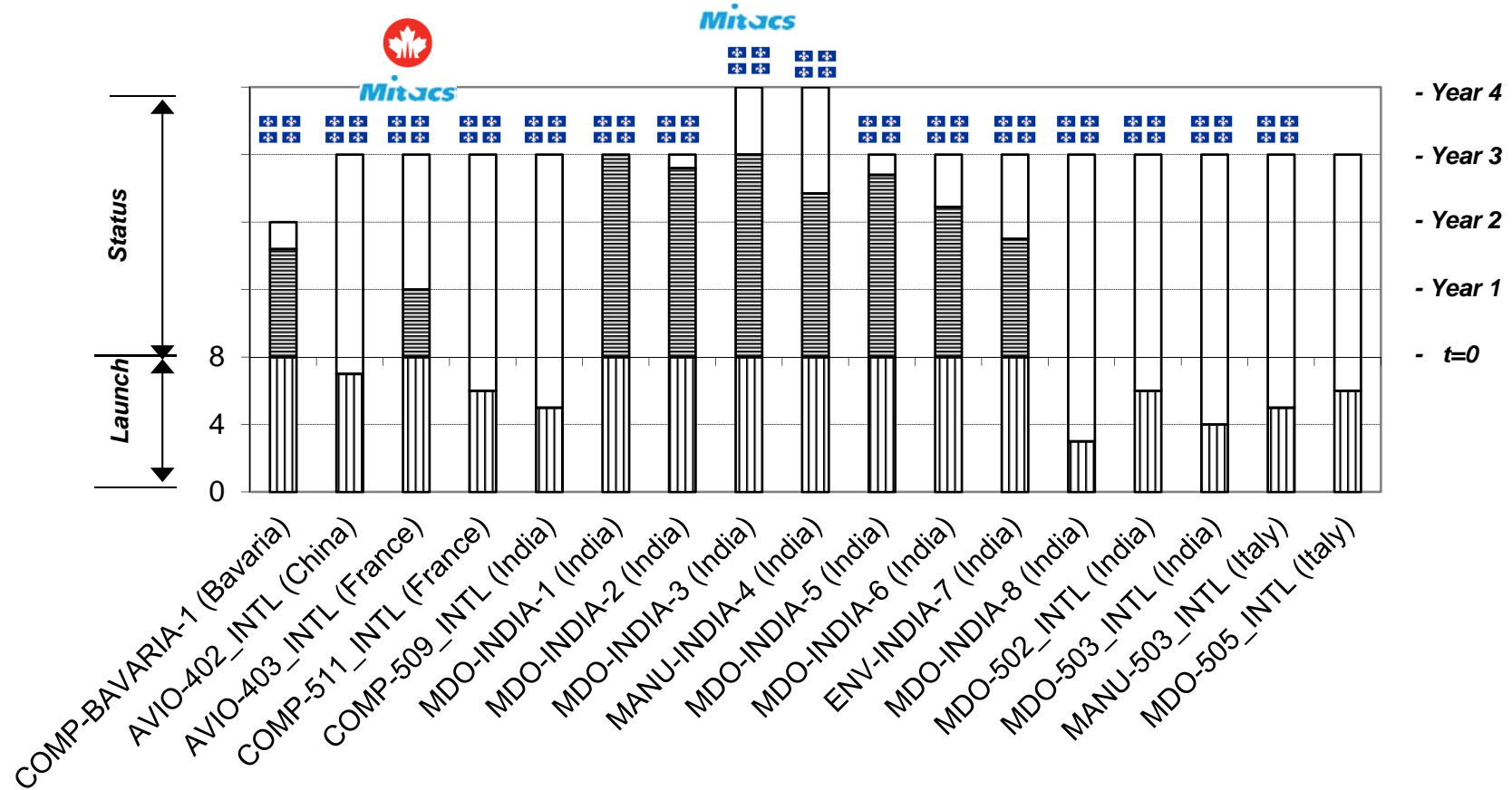
International R&D Collaboration Industry-driven Project Scenario



International Projects

Country	Since	Mission	Projects
Japan	2009	√	
Singapore	2009	√	
China	2008	√	1
Mexico	2008	√	
USA	2008	√	
Poland	2008	√	
Germany	2008	√	1
UK	2007	√	
India	2006	√	11
Italy	2005	√	2
Belgium	2005	√	
France	2004	√	1

International Projects

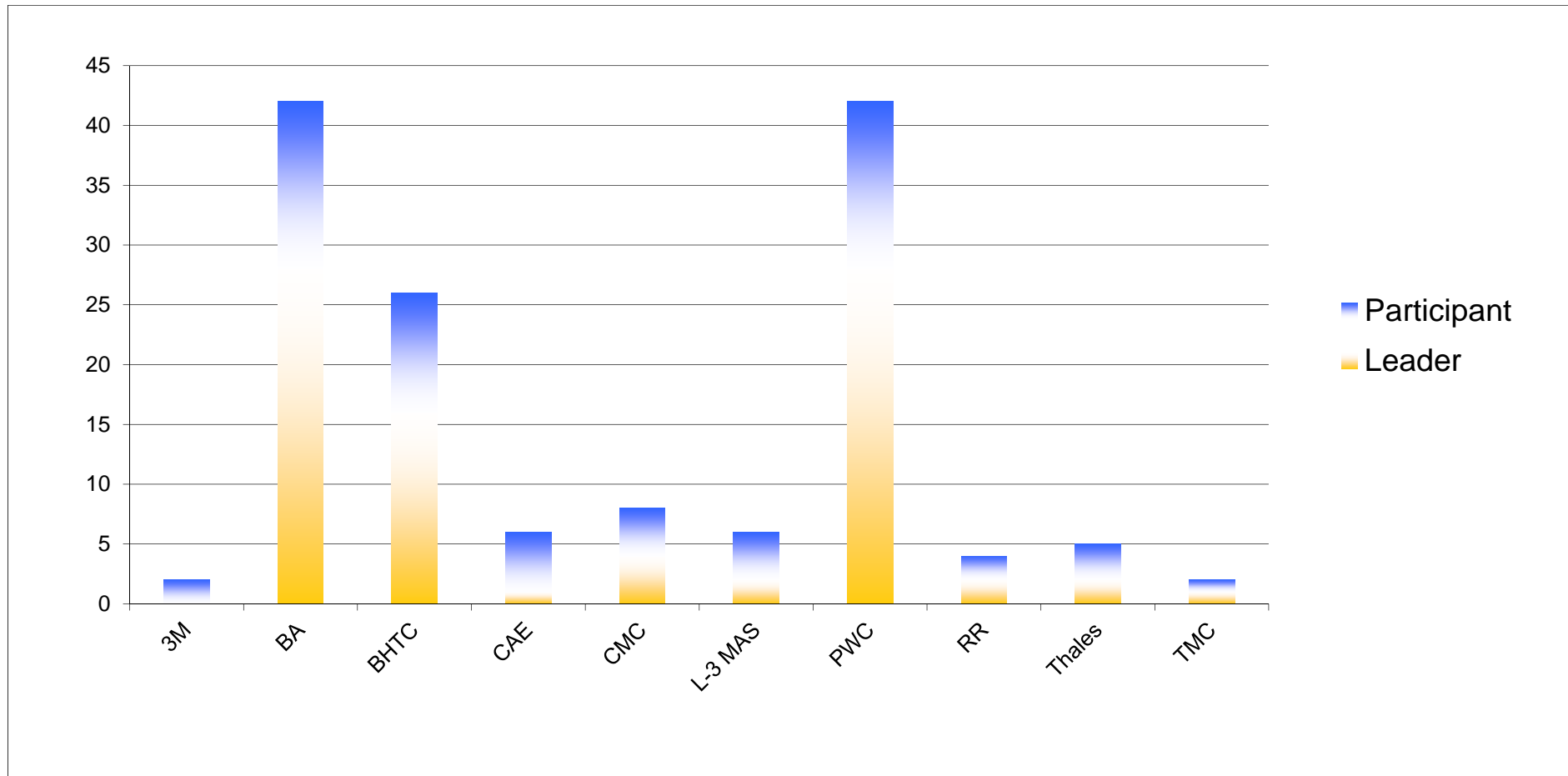


- 8 Project started
- 7 Agreement circulating for signatures
- 6 Agreement circulating for comments
- 5 Agreement in preparation
- 4 Submitted for funding
- 3 SOW and budget ready
- 2 SOW in preparation
- 1 Looking for partners

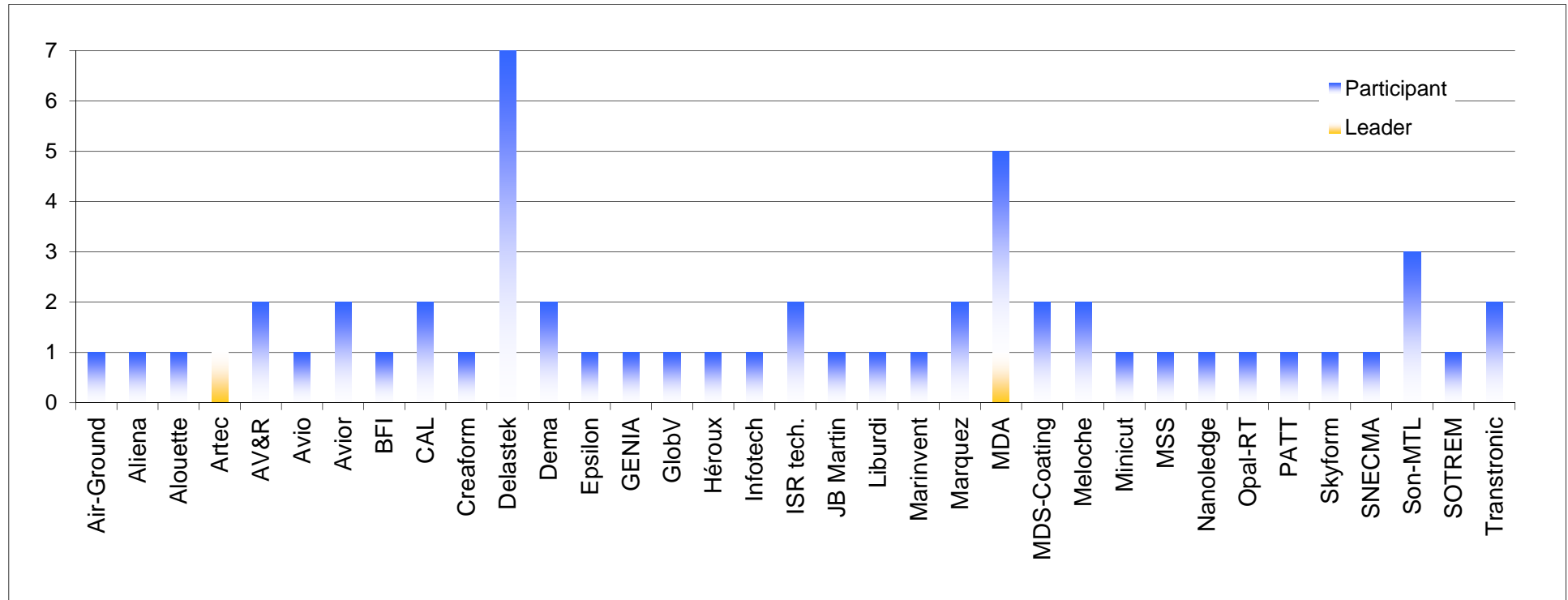
September 2011



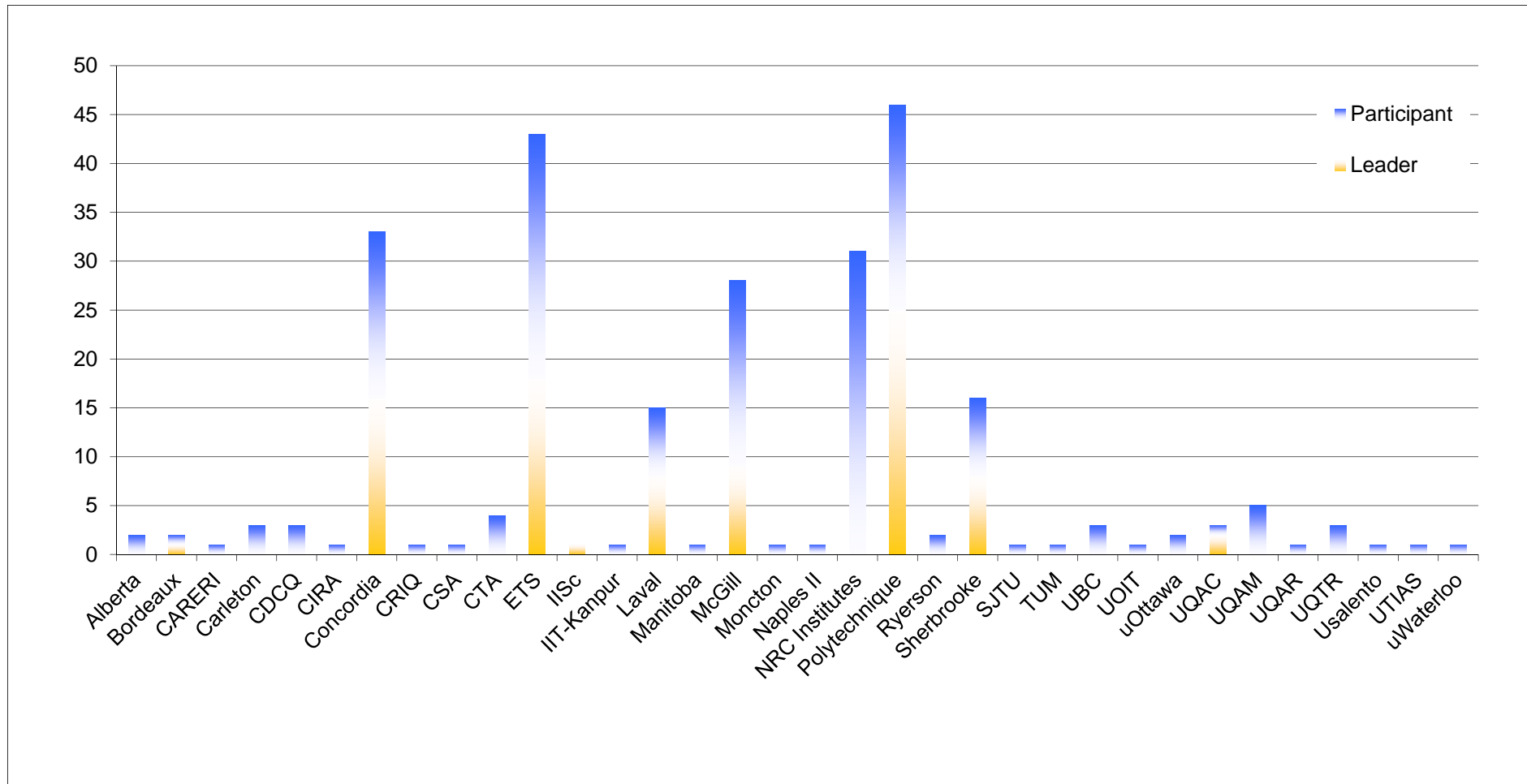
Participation of OEM's and Medium-sized Companies in CRIAQ Projects



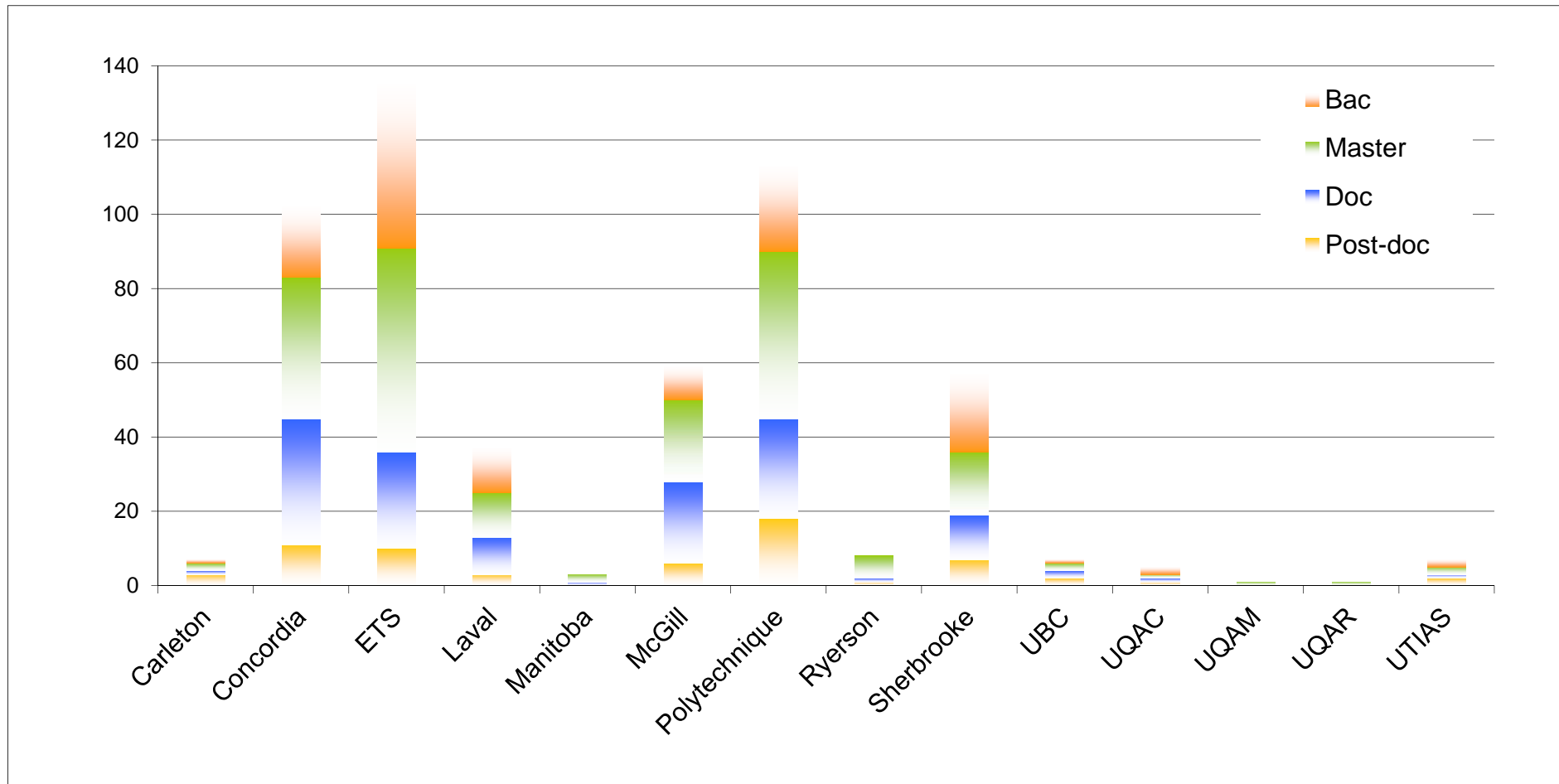
Participation of SME's in CRIAQ Projects



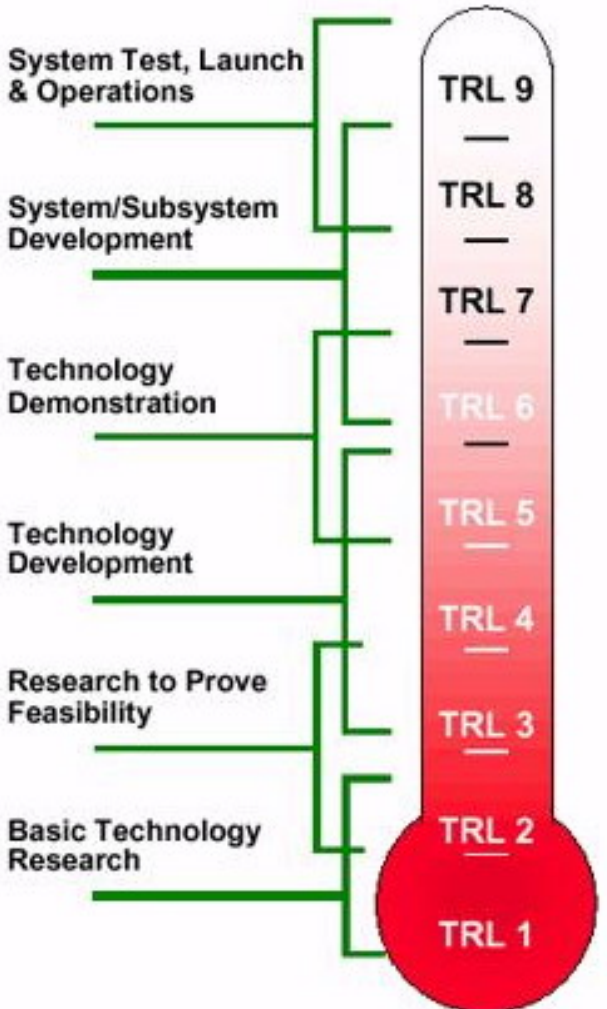
Participation of Universities and Research Centres in CRIAQ Projects



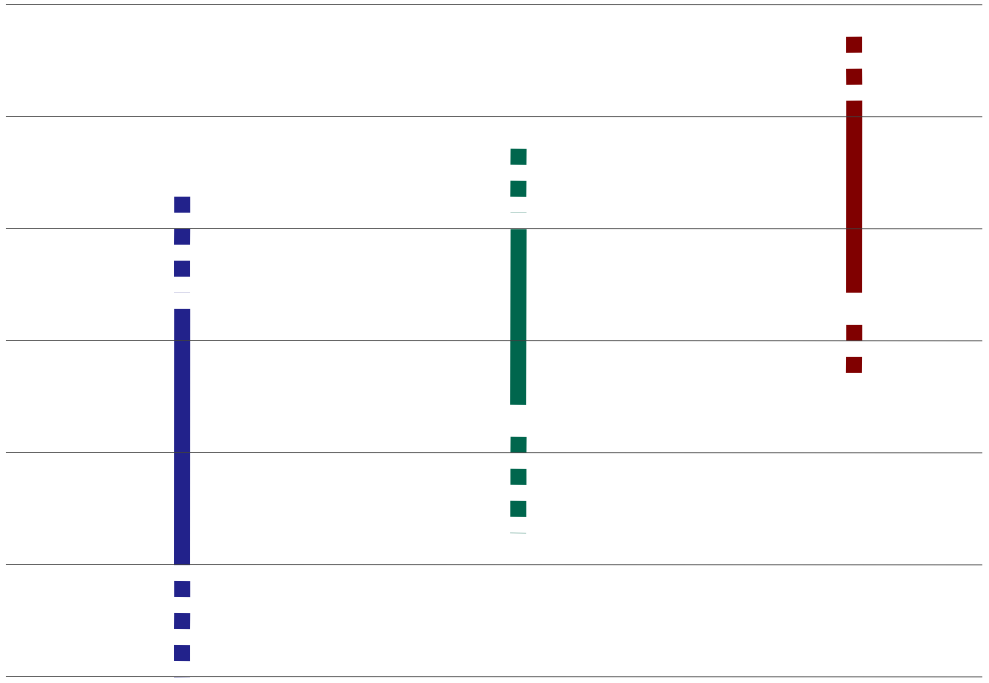
Students and Highly Qualified Personnel in CRIAQ Projects



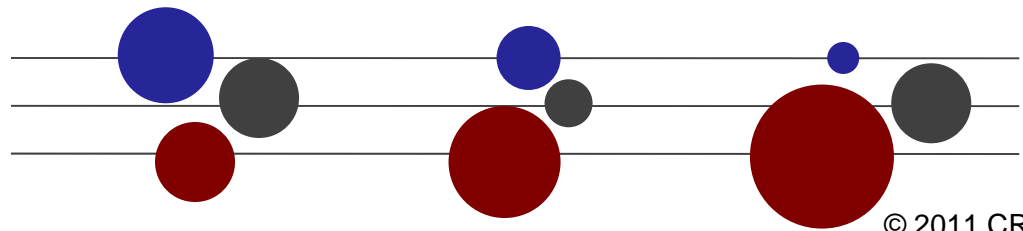
Player Complementarity



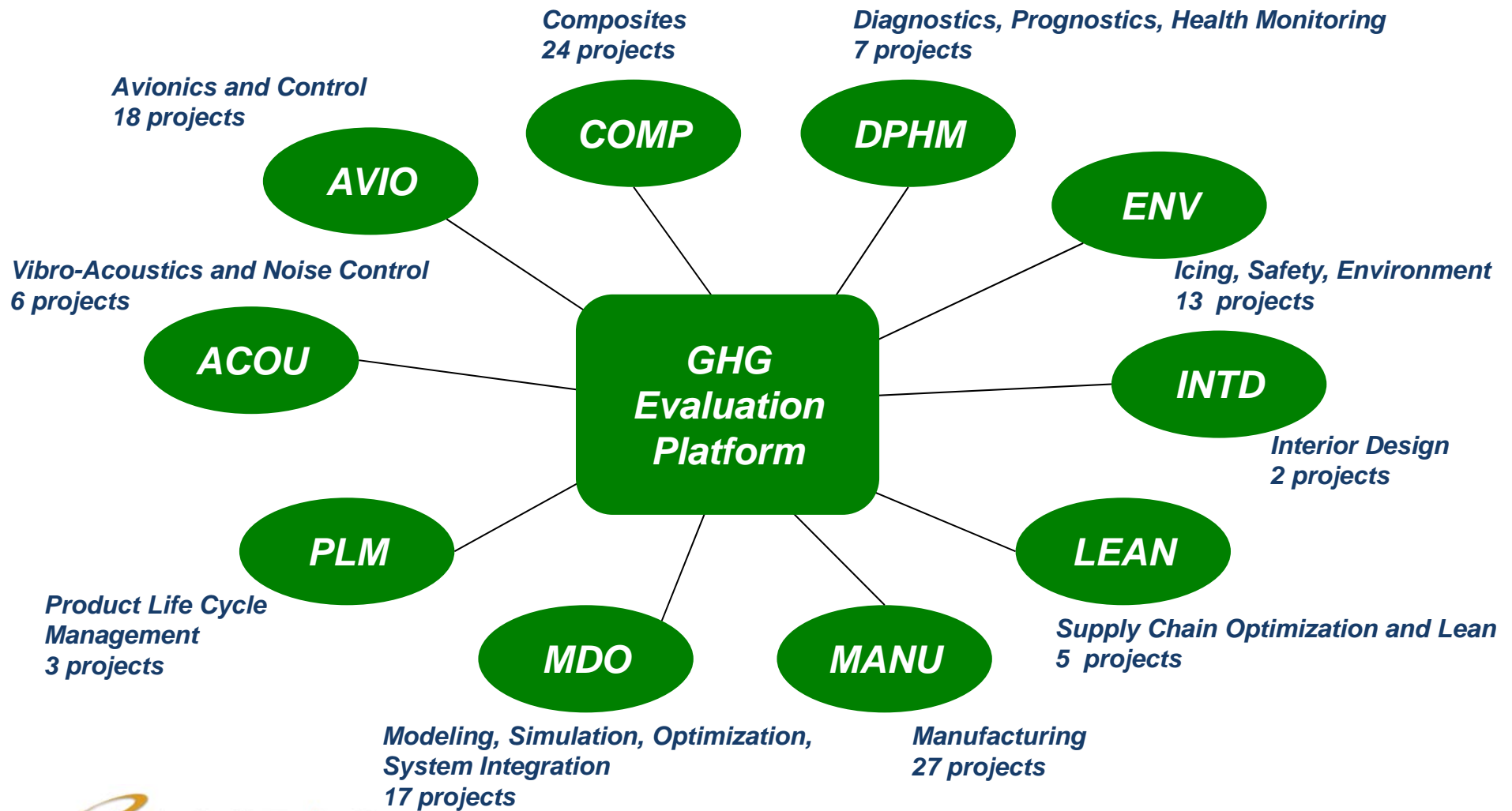
NASA Technology Readiness Levels



Universities
Research Centres
Industry



CRIAQ Research Themes Contribution to GHG Reduction



GHG Evaluation Platform

- Develop an evaluation method of the potential reduction of GHG for the various research themes of CRIAQ;
- Train and support the various research teams to help them quantify the potential impact on GHG reduction of the proposed technology;
- Collect the related GHG data and synthesize the detailed and effective GHG reduction;
- Collect some of the data required to develop a reliable Canadian aerospace database for GHG reduction.

Matrix of GHG Reduction Contributors



Table of criteria for reduction of GHG

Type of project	Weight reduction	Drag reduction	Performance improvements	Product life extension	Reduction of energy requirements	Waste reduction	Toxicity reduction	Improvement of recycling capability	Etc
CRIAQ									
AVIO	█	█	█						
MDO	█	█	█						
ACOU									
DPHM				█					
ENV	█ Synthesis project								
LEAN									
MANU	█				█	█		█	
PLM				█	█				
COMP	█					█	█		
INTD	█			█					



© NACRE Consortium 2008

Conclusion

CRIAQ ...

- Unique Open Innovation Model tailored for Aerospace
- Light networked structure
- Fostering innovation through a number of networking mechanisms
- Strong financial support from Government, (Included in Quebec's Research and Innovation Strategy)
- Financially supported by and Strategic for Industry, Universities, and Research Labs
- Hundreds of researchers, specialists and students
- Active in national and international scenes.
- Looking to play a greater federative role in Canadian aerospace research