Montreal aerospace cluster
Attractors and dynamics

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A presentation to the meeting
Of the Innovation System Research Network
May 9 and 10, 2002
Quebec City

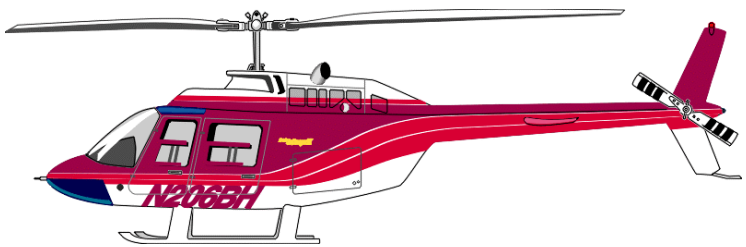
Theories available

- Industrial districts : Marshall and Italian tradition

- Perroux industrial poles

- Regional Innovation Systems : Cooke and Morgan, de la Mothe, Niosi…

- Porter's Clusters and related diamonds



Characteristics of aerospace clusters and industry

- **- Large dominant firms**
- **- High barriers to entry**
- **- Increasing returns and high upfront R&D costs**
- **- World markets for products**
- **- Inertia : large plants imply high sunk costs**
- **- Attractors are large systems integrators, not universities, government laboratories or other institutions.**

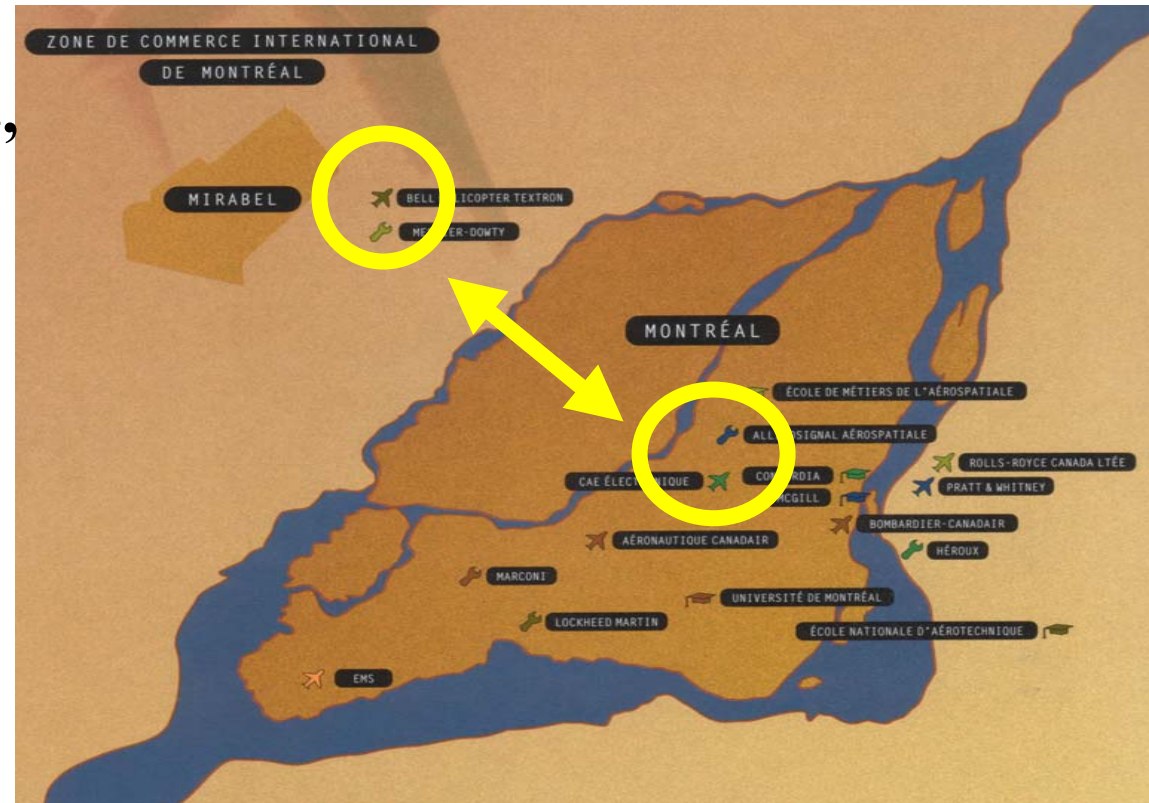
Montreal Cluster

- 260 firms including two large systems integrators (Bell and Bombardier) plus several intermediate product firms (engines, avionics, landing gear)

- Developed over 80 years

- An innovation cluster (business and regional jets, engines and avionics) coexists with a production cluster for helicopters

- Universities and government laboratories play a minor role up to now.



Defining clusters and regional innovation systems

Clusters

« A geographical cluster is here defined as a strong collection of related companies located in a relatively small geographical area. » (Beaudry & Breschi, 2000)

Porter, Michael (2001) : « Clusters are geograpical contrations of interconnected companies and institutions in a particular field. »

Regional innovation systems

“Regions which possess the full panoply of innovation organizations set in an institutional milieu, where systemic linkage and interactive communication among the innovation actors is normal, approach the designation of regional innovation systems”(Cooke and Morgan, 1998)

Regional systems of innovation are sets of institutions (innovating firms, research universities, research funding agencies, venture capital firms and government laboratories and other appropriate public bodies) and the flows of knowledge, personnel, research monies, regulation and embodied technology that occur within a region (metropolitan area, sub-national unit or other). (Niosi, 2001)

Aircraft, biotechnology and software clusters compared

	Aircraft	Biotechnology	Software
Industry age	100 years	20 years	30 years
Industry structure	Large firms dominate	SMEs dominate	Large corporations and SMEs coexist
Clusters attractor	Large assemblers	Public policies for R&D, pool of human capital	Public policies for R&D, pool of human capital
Cluster incubator	None	Research university	Large private R&D labs
Cluster driver	Successful families of aircraft	Successful human health products niche	Sucessful products in the telecom/e-business/internet niche
Typical number of firms in clusters	Over 100 (one or few assemblers, many suppliers)	Over 50 (many competing spin-off firms)	Over 50 (many competing spin-off firms)
Other key participants in clusters	None	Research universities. Venture capital	Venture capital
Examples in the world	Fort Worth, Tx Seattle, Wa Turin Toulouse	San Francisco, San Diego, CA Research Triangle Park, NC	Palo Alto, CA Redwood Shores, CA Redmond, Wa Cambridge, UK Walldorf, Germany
Examples in Canada	Montreal Toronto	Toronto, Montreal, Vancouver	Toronto Ottawa, Montreal, Vancouver
Theories useful	Perroux poles	Human capital and KSs	Human capital and KSs

Successful products in growing clusters

City	Company	Product description	Models	Units sold (and firm orders)	From/up to
Montreal	Bombardier	Challenger Business Jet	CL600; CL601 CL600S; CL601-1A CL601-3A CL604	448 (all models)	1978/mid-1999
Montreal	Bombardier	Fire-fighter Amphibian	CL-215T CL-415	51	1991/mid1999
Montreal	Bombardier	Regional jet	RJ100 RJ100ER RJLR; CRJ200 CRJ700 Global Express	600 (all regional jets) 105 (Global xpress)	1987/Mid-2000
Montreal	Bell Helicopter	Civil helicopter	Bell 212; Bell 412; Bell 222 Bell 230 Bell 430 Bell 407 Bell 427; Bell TR	2000	1985/March-2002
Toulouse	Airbus Industrie	Medium to long range civil aircraft	A300; A310 A319; A320 A321; A330 A340	3375	1972/Sept. 1999
Seattle	Boeing	Medium to long range civil aircraft	737; 747 757; 767 777	3082, 400 872; 779 429	
Seattle	Boeing	Business jet	BBJ	71	1996/March 2002

Sources :

Notes. Models actually being produced only

Other aircraft clusters

City	Company	Product description	Models	Units sold (and firm orders)	From/up to
Toronto	**Bombardier**	Regional aircraft	DHC-8	590	1987/mid-1999
Long Beach CA	**Boeing**	Short to medium range civil aircraft	717	115	1991/mid1999

Employment in Ontario, Quebec and Canada's aerospace industry, 1967-97 (five year averages and % of Canada's total aerospace employment)

Years	Ontario	Quebec	Canada
1967-71	14214 (44%)	14909 (46%)	32282 (100%)
1972-76	10238 (44%)	9750 (42%)	23421 (100%)
1977-81	13041 (40%)	15614 (48%)	32573 (100%)
1982-86	13739 (41%)	16457 (50%)	33163 (100%)
1987-91	18119 (42%)	19118 (44%)	43580 (100%)
1992-96	12378 (32%)	20049 (51%)	39072 (100%)
1997	13838 (32%)	22310 (51%)	44085 (100%)

Source : Statistics Canada

Other indicators, Canadian Aircraft, 2000

Variable	Montreal	Toronto	Winnipeg	Vancouver	Halifax	Ottawa	Calgary
Key firms	8	9	3	2	2	2	3
Employment	18595	11943	2300	1325	1160	1135	375
Employment (%)	50.4	32.4	6.2	3.6	3.1	3.1	1.1
Average number of employees per firm	2324	1327	766	663	580	568	135
Median number of employees per firm	1050	760	700	663	580	568	75
Average age of firms	69	45	43	19	21	44	28
Median age of firms	59	51	30	18	21	44	25

Figure 1. Aircraft & Aircraft Parts Establishments

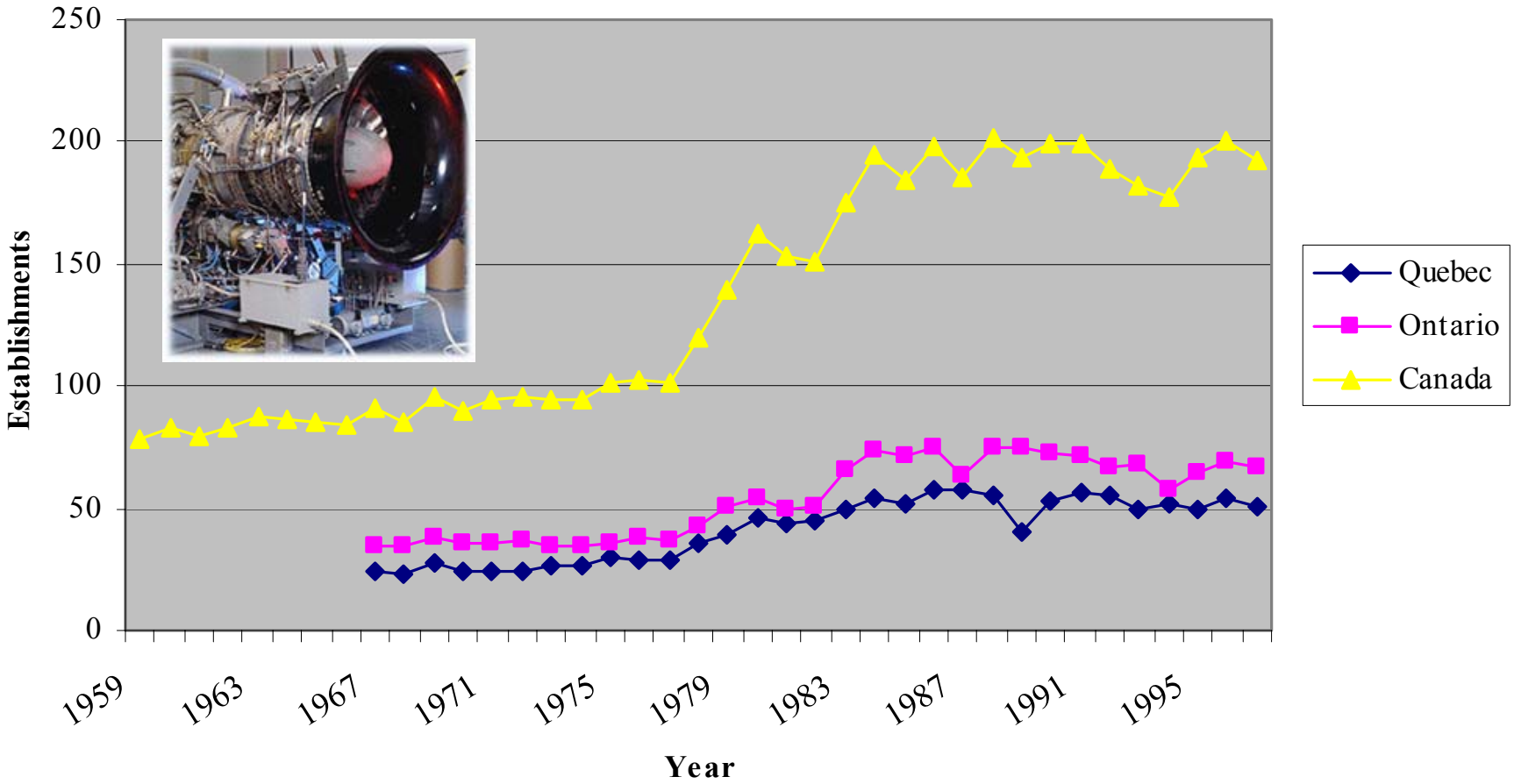


Figure 2: Aircraft & Aircraft Parts Employees

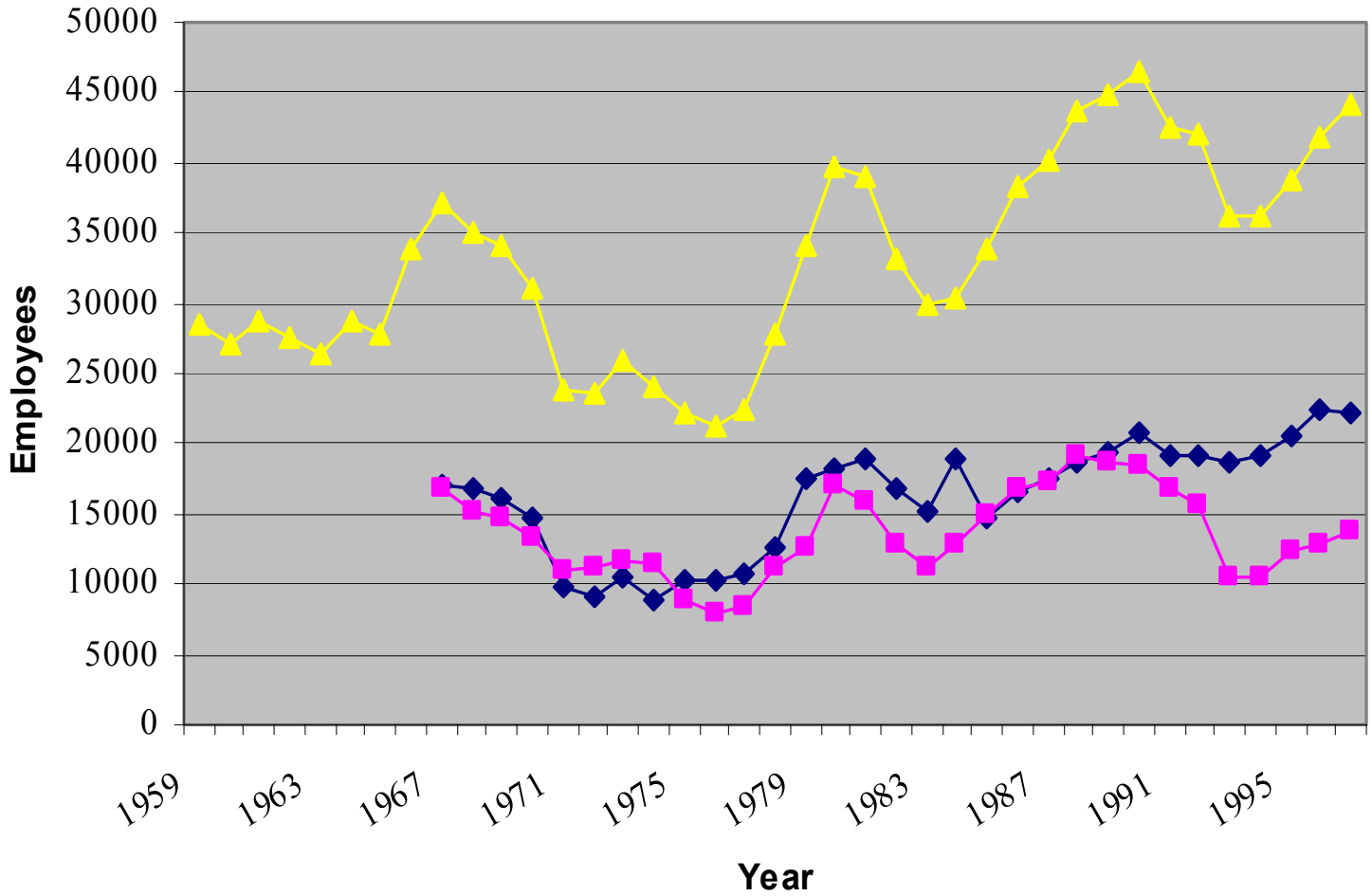
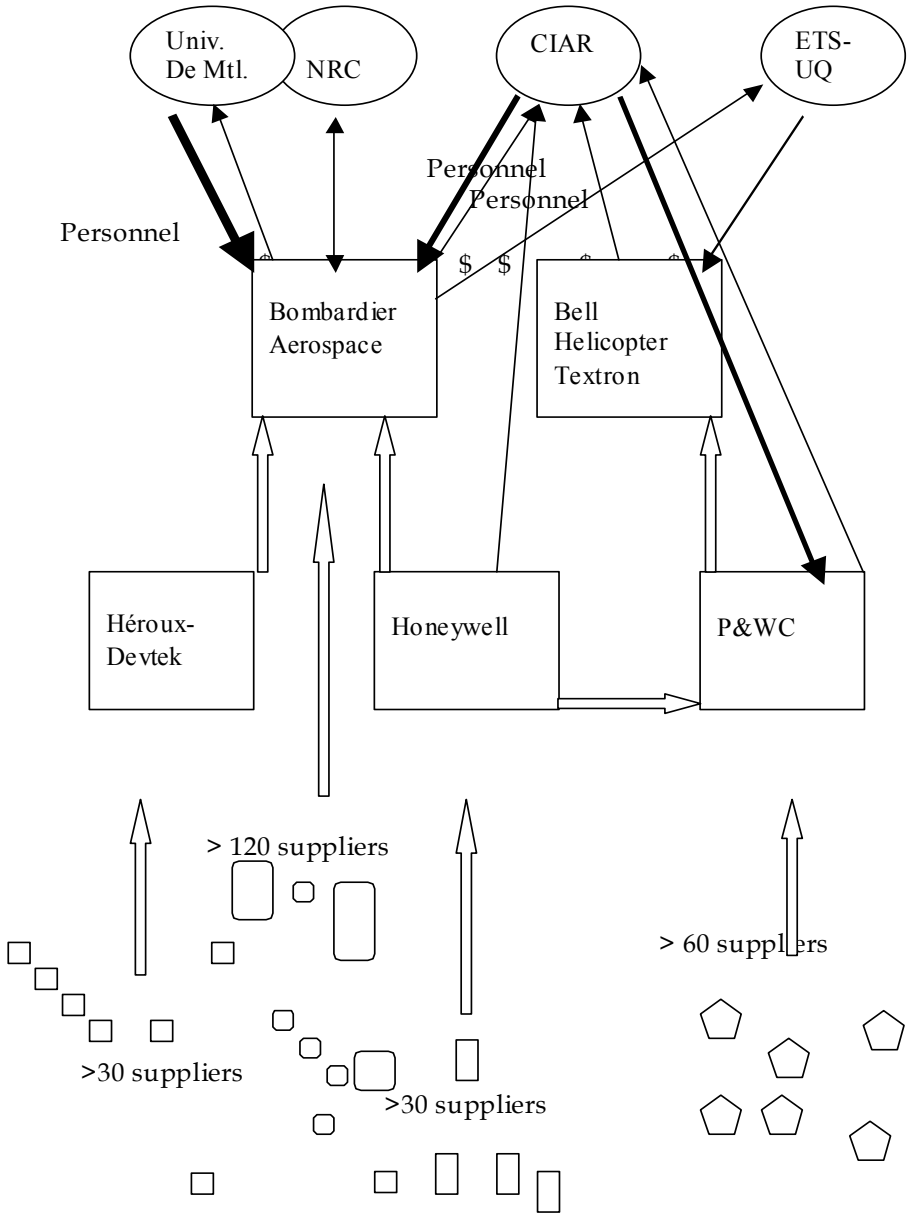
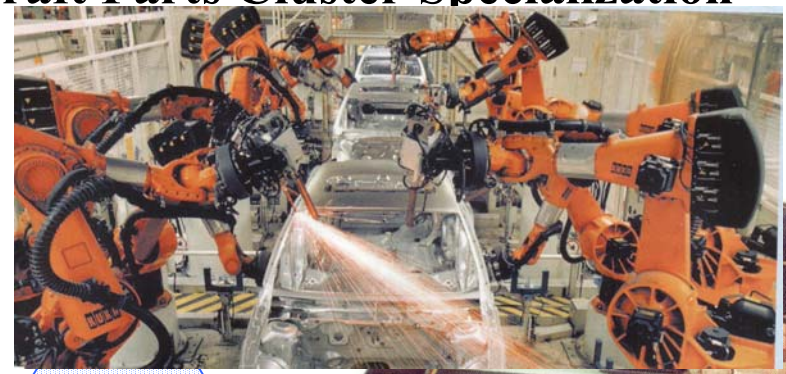


Figure 3: Montreal aerospace cluster



Montreal Aircraft and Aircraft Parts Cluster Specialization



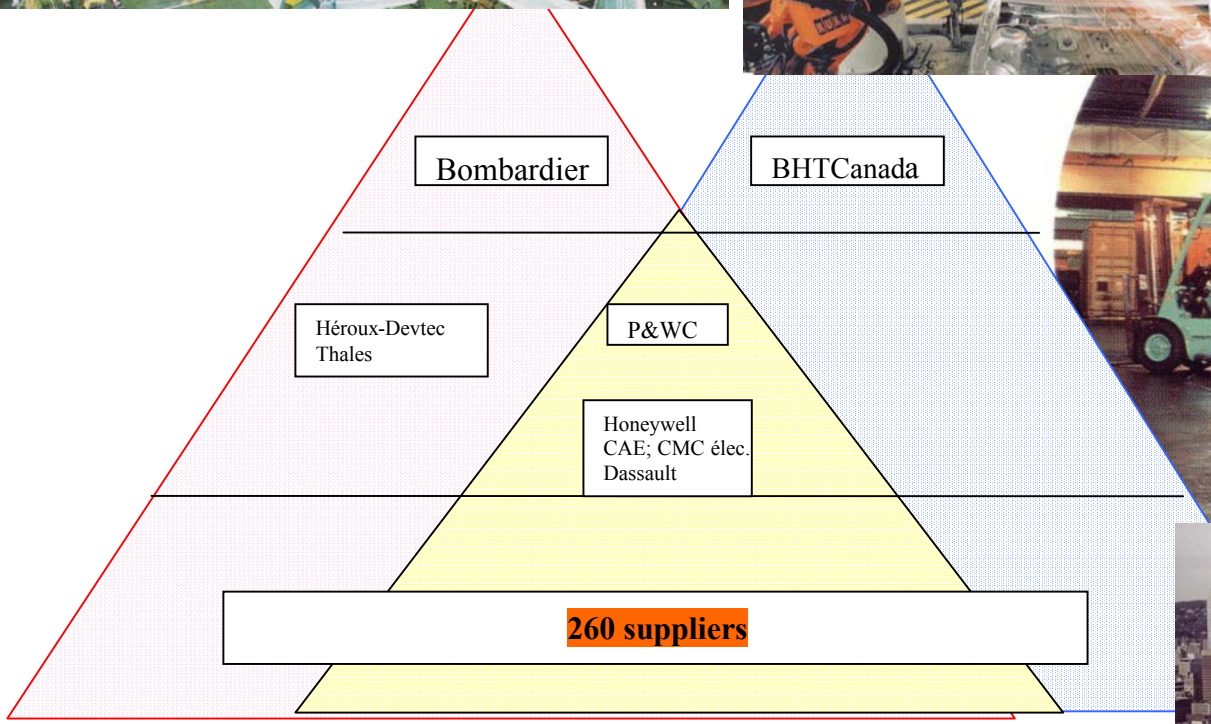


Figure 5: Aircraft and Aircraft Parts Establishments by the foundation Year

Conclusions

1. Aerospace clusters are neither Marshallian industrial districts nor Porterian clusters but Perrouvian industrial poles, dominated by large corporations

2. Montreal combines both an innovation and a production cluster.

3. The role of universities and government laboratories is secondary.

4. The dynamics of the industry depends on the continuous success of families of products in world, not local markets.

5. Inertia due to large sunk costs in major plants make that aerospace cluster are long-term phenomena.

6. Finally, specialization is the characteristic of most aerospace clusters, with Montreal one of the major exceptions to the trend