

6° Rencontres Droit et Espace
«SIRIUS SPACE DAYS»

***Petits satellites : La miniaturisation
des satellites est-elle une
innovation de rupture?***

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Research question

- Is a new technology a threat or an opportunity for existing firms?
- Empirical framework
 - Small satellites
 - Satellite manufacturers
- Theoretical framework
 - Disruptive innovation theory (Christensen (1997))
 - Innovator's dilemma
 - Disruptive innovation

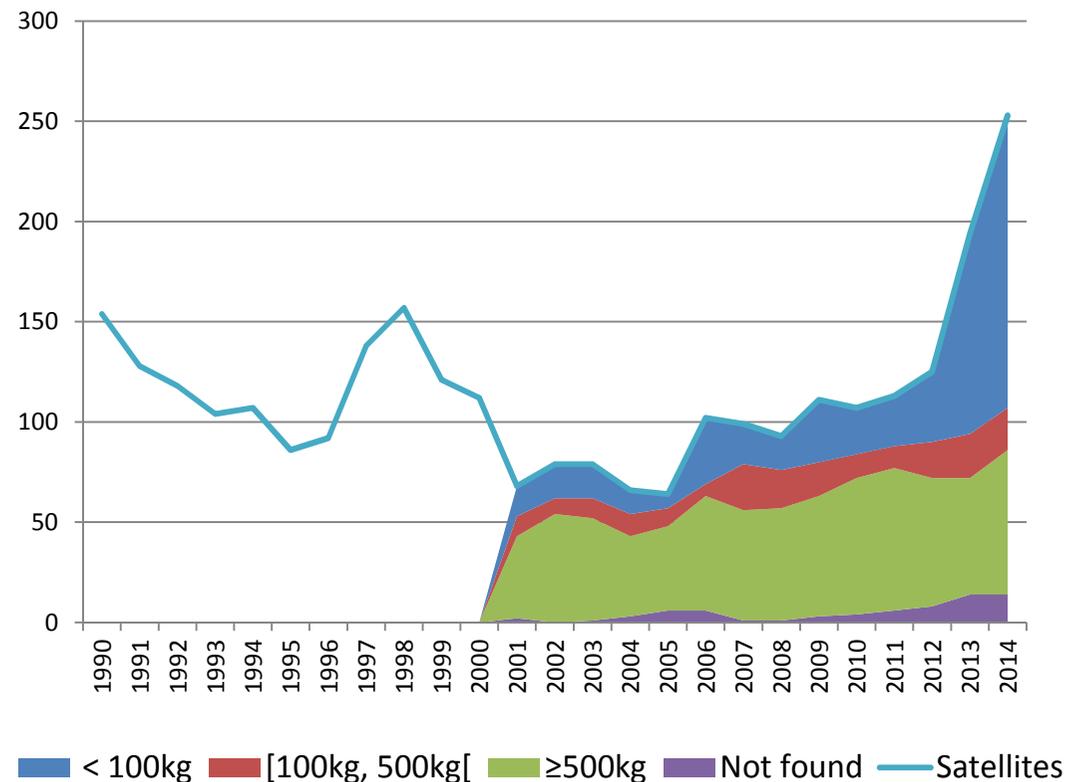
Innovator's dilemma

- Observations of existing firms
 - **New entrants investing in a new technology**
 - New technology does not meet the margins or the volumes requirements dictated by their size
 - **The new technology is not good enough for their mainstream customers**
- Interrogations of existing firms
 - Do they need to engage significantly in this new market segment ?
 - **This immature technology may become a substitute of the existing technology?**
 - **Should they invest today in the new technology and cannibalize their existing technology to ensure their survival in the long term?**

Table 2. The new entrants

Date	Nb.	New entrant name
1985-2013	13	SSTL, Satrec initiative, Deimos Space, Geo-optics, Gomspace, Clyde Space, Skybox imaging, Novanano, Planet labs, Dauria Aerospace, Tyvak, Nanosatellite systems, PlanetiQ, OmniEarth

Figure 2. Satellite launches and mass



Issues of disruptive innovation theory

- Strong **confusion** regarding what is exactly a disruptive innovation
 - Disruptive, radical, discontinuous and breakthrough innovations are not synonyms
- Disruptive innovation concept **cannot be used to make ex-ante predictions**
 - Characteristics and influence are dramatically different in short term and long term
 - We do not know about the long term nature and influence
- Existing firms need to know whether the innovation they currently observe is a disruptive innovation or not
 - Danneels (2004) suggests to develop the concept of **potential disruptive innovation**
 - Short term characteristics of disruptive innovations

Potential disruptive innovations

Characteristics	
Name	
<u>Techno.</u>	Lower performance compared on the performance criteria valued by mainstream customers (1)
	Introduce new performance criteria not valued by mainstream customers (2)
	Simpler (3)
	Less expensive to produce and offered at a lower price (4)
	Offered at a higher price (5)
<u>Demand</u>	Do not appeal existing mainstream customers (6)
	Appeal existing customers (7)
	Appeal new customers in new market (8)
	Appeal price sensitive customers (9)
	Appeal no price sensitive customers (10)
Threat for existing firms	

Potential disruptive innovations

Characteristics		Type 1	Type 2	Type 3
Name		Existing market low-end	New fringe-market low-end	New detached-market high-end
Techno.	Lower performance compared on the performance criteria valued by mainstream customers (1)	X	X	X
	Introduce new performance criteria not valued by mainstream customers (2)	X	X	X
	Simpler (3)	X	X	X
Cost & Price	Less expensive to produce and offered at a lower price (4)	X	X	
	Offered at a higher price (5)			X
Demand	Do not appeal existing mainstream customers (6)	X	X	X
Market novelty	Appeal existing customers (7)	X		
	Appeal new customers in new market (8)		X	X
Willing. to pay	Appeal price sensitive customers (9)	X	X	
	Appeal no price sensitive customers (10)			X
Threat for existing firms		High	Lower	Lower

Results

Small satellites

Characteristics		Type 1	Type 2	Type 3
Name		Existing market low-end	New fringe- market low-end	New detached- market high-end
Techno.	Lower performance compared on the performance criteria valued by mainstream customers (1)	Accepted: Life span (2.6), Power (6.0), Resolution, Visibility		
	Introduce new performance criteria not valued by mainstream customers (2)	Accepted: No industrial standard but: Designed, manufactured and launched faster; Lower latency, Global coverage (constellations)		
	Simpler (3)	Accepted: Mass (15.5)		
Cost & Price	Less expensive to produce and offered at a lower price (4)	Accepted: Mass (15.5), COTS, designed, manufactured and launched faster		
	Offered at a higher price (5)			Accepted: Constellations

- The 3 types are possible

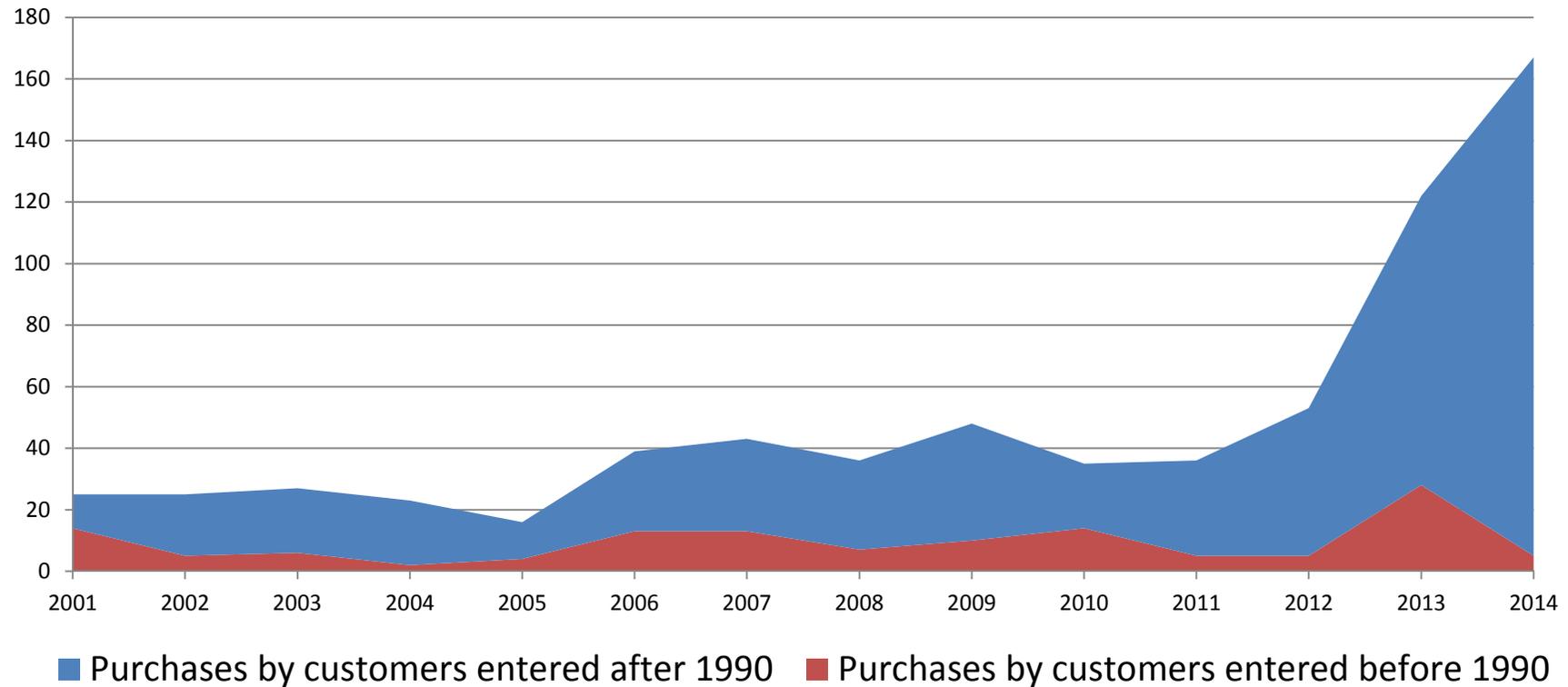
Small satellites

Characteristics		Type 1	Type 2	Type 3
Name		Existing market low-end	New fringe-market low-end	New detached-market high-end
Demand	Do not appeal existing mainstream customers (6)	Accepted		
Market novelty	Appeal existing customers (7)	Rejected: Not type 1		
	Appeal new customers in new market (8)		Accepted: 3.9 times more purchases	
Willingness to pay	Appeal price sensitive customers (9)	-	Accepted: New institutional from customers dev. countries	
	Appeal no price sensitive customers (10)			Accepted: New commercial customers
Nature		Rejected	Accepted	Accepted

- Small satellites address both high-end and low-end new customers
- Small satellites are a potential disruptive innovations from type 2 and type 3

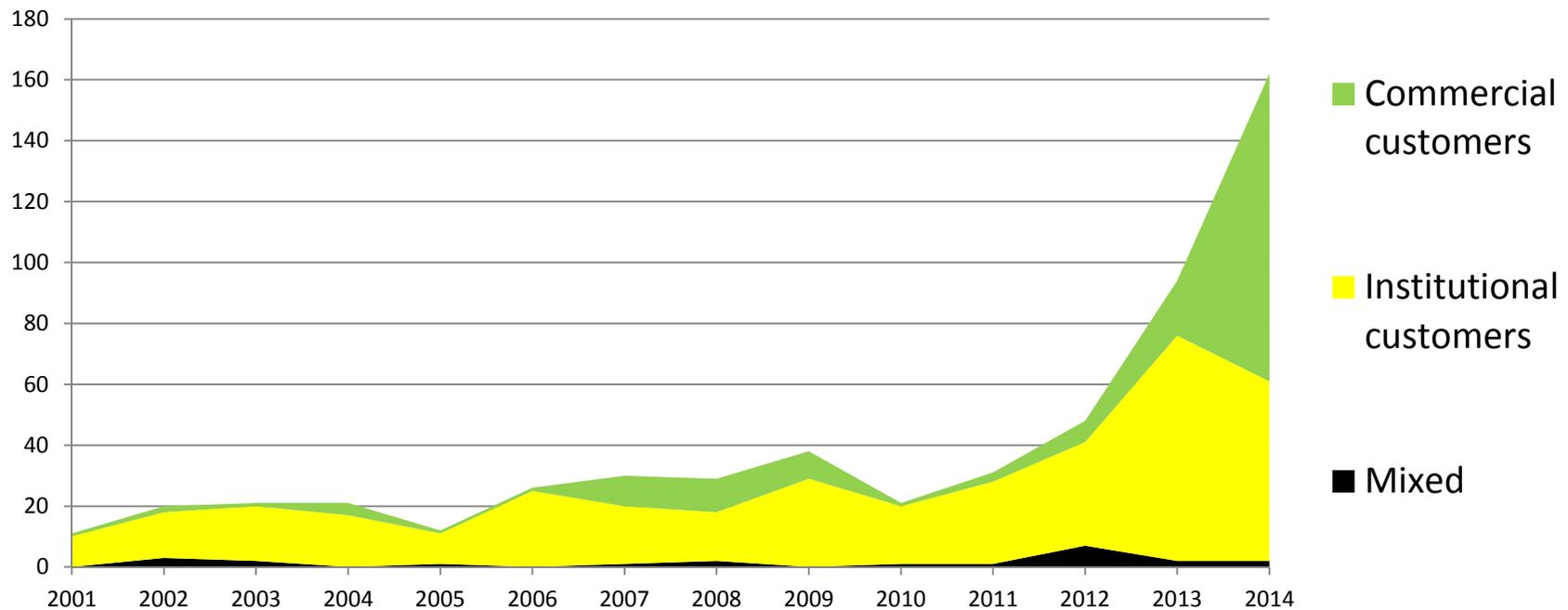
Demand analysis: market novelty

Figure 3. Evolution of purchases of small satellites (2001-2014)



Demand analysis: Willingness to pay

Figure 4. Purchases of small satellites by new customers (2001-2014)



Small satellites

Characteristics		Type 1	Type 2	Type 3
Name		Existing market low-end	New fringe-market low-end	New detached-market high-end
Threat for existing firms			Low	Low

- Small satellites are an imperfect substitute of typical satellites
- These two products
 - have very different performance criteria
 - Existing criteria (e.g. life time, power)
 - Removed criteria (e.g. geostationary orbit)
 - New criteria (e.g. lower latency, time to market, global coverage)
 - are sold in different markets with particular market rules

Discussion (1)

- Similar patterns



- Type 2

- Unmanned aircraft VS manned aircraft
 - Personal computers VS Mini-computers



- Type 3

- Mobile phones VS Landlines



Discussion (2)

- 3 markets main may exist if small satellites diffuse
 - Existing market
 - Typical satellites (> 500kg)
 - Typical applications
 - New fringe-market
 - Small satellites (< 500 kg)
 - Emerging and developing customers
 - Typical applications
 - New detached-market
 - Constellations of small satellites (< 500kg)
 - New commercial customers (new space actors?)
 - New applications

Discussion (3)

- Small satellites can be an opportunity for existing firms if
 - Existing firms create a new business unit (or a new organization) to cope with
 - the cannibalization issue
 - the need to create new processes
 - (Christensen and Bower, 1996, Govindarajan and Kopalle, 2006; Yu and Hang, 2010)
- Limitations
 - We do not know if small satellites will diffuse
 - e.g. Iridium
 - We do not analyze the availability of launchers

- Thank you for your attention!



5° Ateliers Droit et Espace

