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New Planes, New Materials(?), New Supply Chain(?)

Implications Of Next Generation Aircraft Designs

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Fairmont Provides Due Diligence And Strategy Consulting To Clients Active In Aerospace, Defense & Government Services









Fairmont Consulting Group provides two inter-related services to corporate clients, private equity sponsors, and lenders active in aerospace, defense and government services

DILIGENCE

M&A due diligence on behalf of buyers and lenders

STRATEGY

Strategy consulting for corporate clients and PE portfolio companies

Fairmont's diligence and strategy work helps clients achieve ***three principal objectives***

Measure Value

- Rigorous, detailed bottom-up analysis of businesses, either for buy-side diligence or internal strategic planning purposes
- Quantified through a historical and forecast financial analysis (revenue & profit) at the customer, product, service, and/or platform level

Reduce Risk

- Identify the range of factors which could adversely affect the business and quantify their potential impact
- Offer recommendations regarding practical near-term and long-term actions that can eliminate or reduce those risks

Drive Growth

- Develop near-term plans and long-term strategies for profitable growth
- Pursue core market growth via business development, R&D, CapEx, personnel, acquisitions
- Assess adjacent markets: comparative evaluation, pursuit via acquisitions, investments

Presentation Overview

- With a focus on aerostructures, the goal of this presentation is to provide thoughts on key issues for the raw materials supply chain to consider in the next decade

1. Discuss the context that the current market provides for considering likely next generation aircraft designs

2. Discuss what conclusions can be drawn about the next generation of aircraft and the market environment they will be produced in

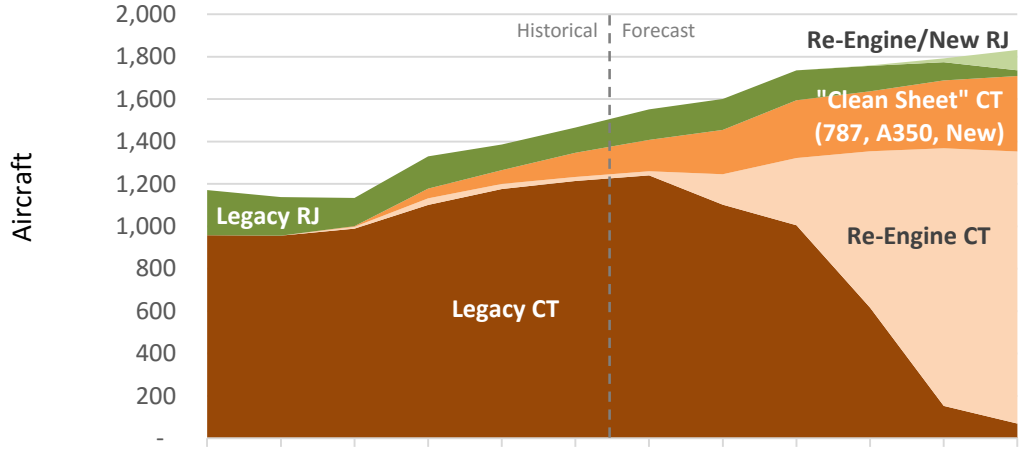
3. Highlight important strategic considerations for the raw materials supply chain going forward

Table Of Contents

Aerostructure Market Will See Fewer "New" Work Packages In Through The End Of The Decade

Delivery Outlook – Fairmont Most Likely Case

Aircraft Units By Generation



			2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
New	C	C919											2	2
	C	CSeries								10	24	36	48	60
Airbus	L	A320ceo	393	390	414	450	489	489	481	392	288	144		
	R	A320neo							2	131	288	431	575	575
	L	A330ceo	71	82	84	97	103	108	113	66	66	36		
	R	A330neo										35	69	60
	C	A350						1	13	67	105	103	126	138
	L	A380	10	18	26	30	25	30	25	25	25	25	25	17
Boeing	L	737NG	365	376	372	415	440	482	504	504	546	330	59	
	R	737MAX									18	260	566	624
	R	747-8			9	31	24	19	17	13	12	12	6	
	L	767	13	12	20	26	21	6	18	15	8	9	9	8
	L	777	88	74	73	83	98	99	100	100	72	72	60	45
	R	777X												25
	C	787			3	46	65	113	135	132	144	144	144	156

Legacy platforms 747 and A340 also included above; All exclude military applications

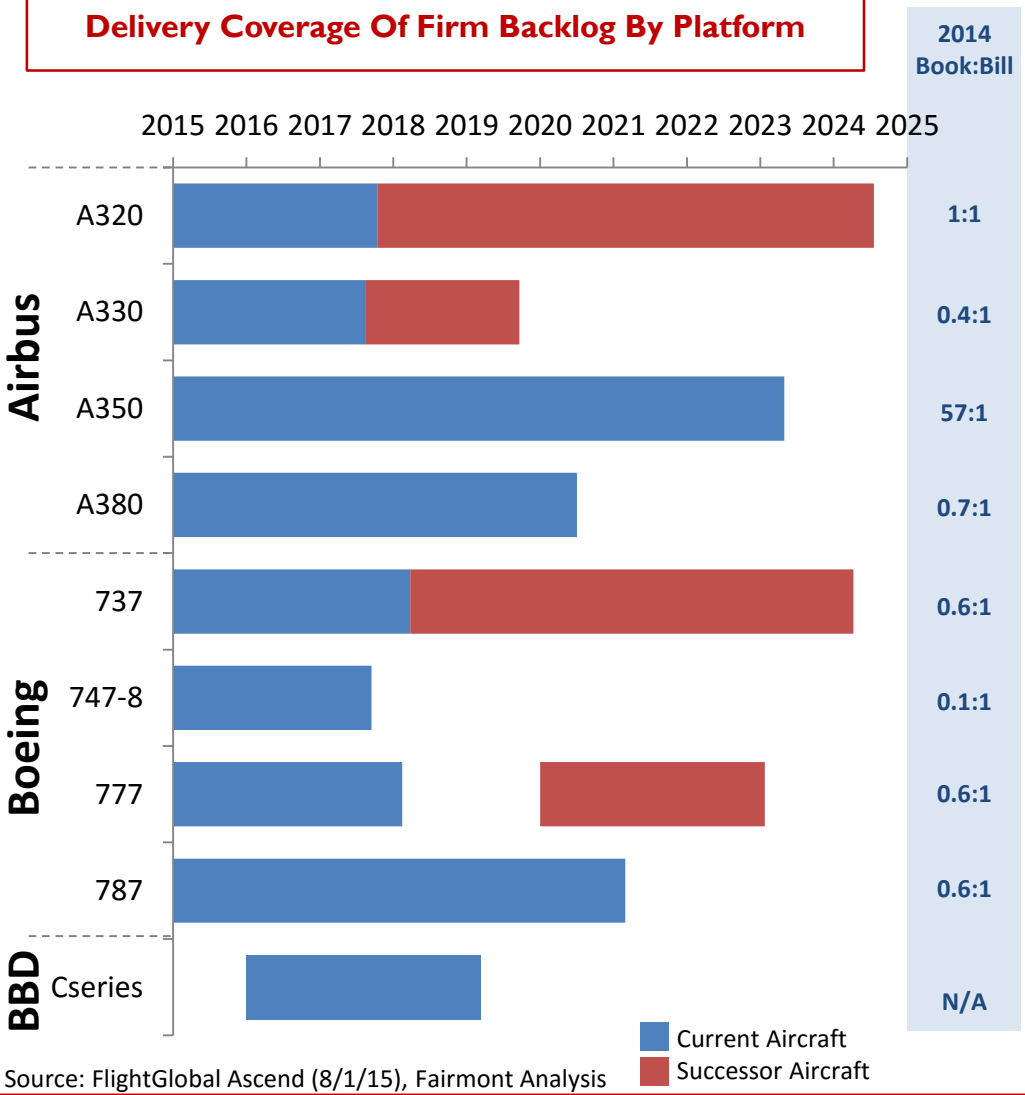
SOURCE: Aircraft OEMs, TEAL Group, Leeham News, Aviation Week, Flight Global and Fairmont Analysis

- Particularly with the growth of high volume single aisle aircraft, Fairmont anticipates continued production rate growth through the end of the decade
  - Single aisle aircraft (737 and A320 families, Cseries and C919) total deliveries have a 5.0% CAGR from 2015 to 2020, while twin aisle aircraft are anticipated only to grow at 1.3%
- However, over 80% of deliveries in 2020 will use airframes already in production (or partially modified)
  - In the context of aerostructures providers, re-engined platforms suggest a competitive environment more focused on lowering costs, and will most likely favor incumbents

The next 5 years will see greater transition in the engine supply chain, while the aerostructures supply chain will see fewer new opportunities

Production Outlook For Commercial Transport Market, Main Driver Of The Engine Market, Is Secured By Substantial Backlog

Delivery Coverage Of Firm Backlog By Platform



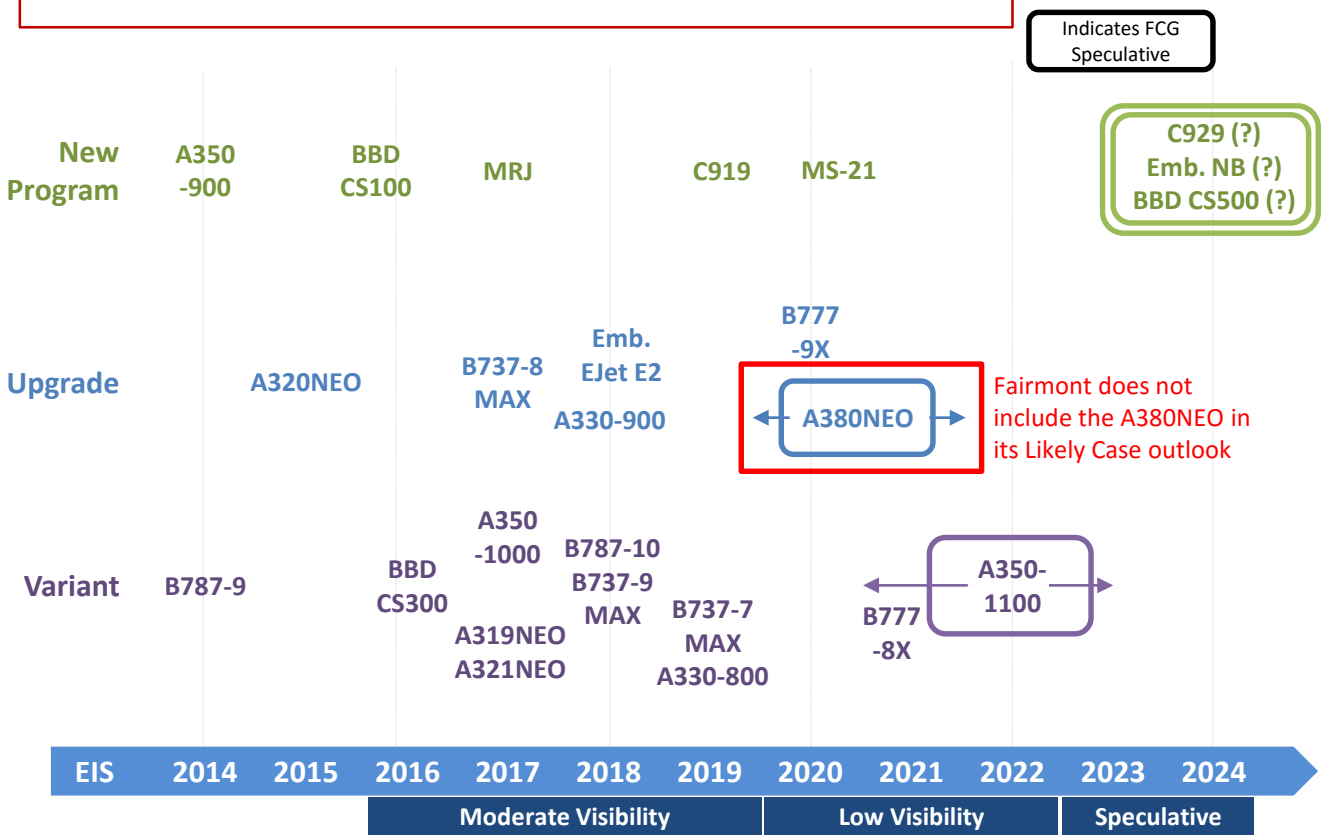
Source: FlightGlobal Ascend (8/1/15), Fairmont Analysis

- Record airframe OEM order books provide significant visibility to market outlook
- Historic backlog of single aisle aircraft (over 9,000) secure current Boeing and Airbus production plans beyond 2024
- A350XWB and 787 are still paying off investment costs and have long backlogs

OEMs unlikely to consider developments that directly compete with the core A320NEO/737MAX or A350XWB/787 markets

Relatively Few New Programs Or Upgrades Appear Likely To Enter Service After The Turn Of The Decade

Announced And Potential Commercial Platform Introductions



- A new wave of long-anticipated programs will enter service in the next five years
  - In addition to re-engined single aisle aircraft from Boeing and Airbus, Bombardier's Cseries and new regional jets will come online
- Relatively fewer new aircraft are likely to be introduced in the five years that follow
  - Any meaningful upgrade entering the market before 2021 would have been announced by now

SOURCE: Aircraft OEMs, TEAL Group, Leeham News, Aviation Week, Flight Global and Fairmont Analysis

The period from 2020 to 2024 represents a lighter period of introductions not only for new programs, but also upgrades and variants, limiting greenfield sourcing activities later in this decade

Table Of Contents

So What Comes Next?

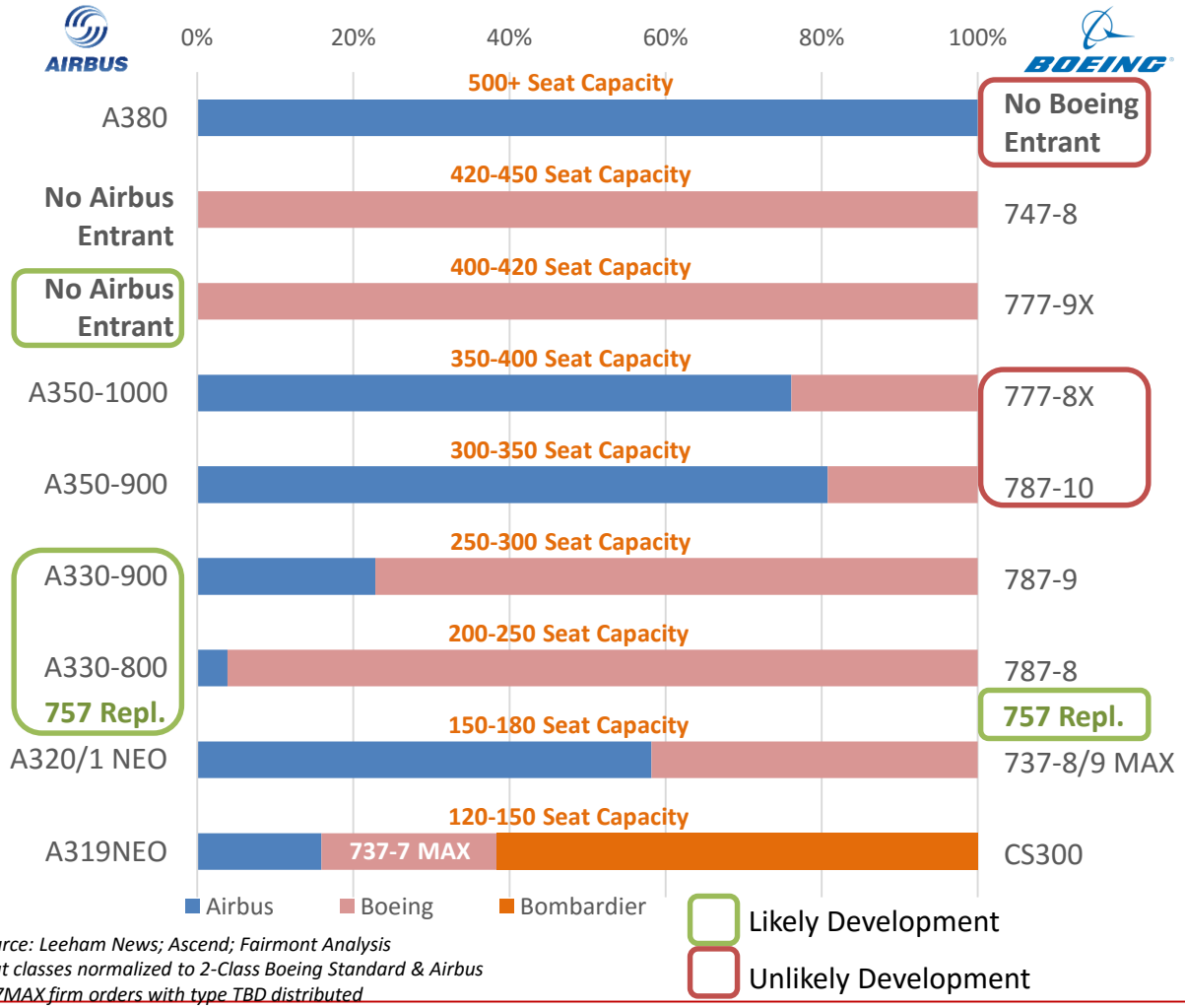
- ***OEMs*** face one set of questions:
- ***Suppliers*** face a different set of questions:

	OEMs face one set of questions:	***Suppliers*** face a different set of questions:
Customer	• How is growth of air travel demand evolving? • How are customer preferences for point-to-point versus hub-and-spoke travel evolving?	• ***Who will be my customer?*** • ***Where will my customer be?***
Design & Capabilities	• What routes are not served, underserved, or served inefficiently in terms of capacity and range? • What aircraft currently meets the identified need? How many are there? When might they retire? • Can I design an aircraft that offers a compelling difference over and above customer's current solution? • How quickly can this design be produced?	• Via my own investment, can I enable my customers to exploit new designs or differentiation? • Based on the design they have chosen, does my customer need the capabilities I have, or must I invest in new capabilities? • ***At what rate will my customer require the components I fabricate or assemble?***
Market	• What is my competitor doing? Are their new competitors? • ***What other investments constrain new development? Will I cannibalize existing products?***	• ***Would my customer prefer to have this capability in-house?*** • Who else could my customer turn to for the capabilities I offer?

While inter-related, many key questions for suppliers considering next generation programs can be explored without fully defining answers to questions facing OEMs

New Platforms Will Be Targeted At Gaps In Existing Lineups Or Areas Where Competitive Position Is Unfavorable

Total Order Comparisons By Competing Aircraft



Source: Leeham News; Ascend; Fairmont Analysis
Seat classes normalized to 2-Class Boeing Standard & Airbus
737MAX firm orders with type TBD distributed

- Market discussion for new clean sheet design have converged on a light twin/large single aisle "Middle Of the Market" niche currently occupied by the 757
  - Challenge for Boeing is in not cannibalizing 787 market, or disrupting 737 orders
- Airbus could also consider a new design to address the 400-420 seat category but likely hesitant prior to final decisions on an A380NEO
- *Most importantly, none of these options are likely to be high rate programs (> 10 per month)*

Long Materials Development Cycles Provides Visibility To Next Generation; Engines Seeing Greater Materials Focus

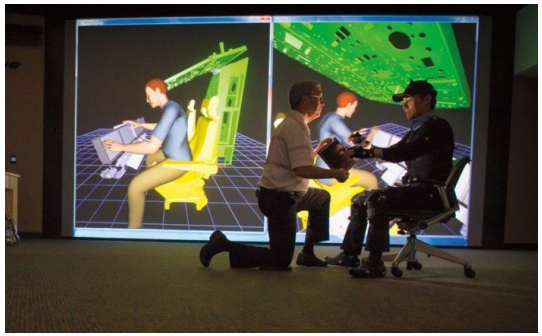
		Maturity	Notable Applications	Next Gen Roles	Comments
Legacy Materials	Aluminum		*Everything*	*Frames, Common Designs*	Venerable, but share can only decline; Likely to see incremental replacement by Al-Li and CF/E
	Titanium		*Numerous*	*High load structures*	Relatively expensive
	Carbon Fiber / Epoxy		*A350/787*	*Wings*	3D reinforcements interesting new avenue, but real revolution will be out-of-autoclave systems
New Materials	Aluminum Lithium		*Some A350/787* ~~*MRJ*~~ *CSeries* ~~*777X*~~	*Fuselage Skins*	Offers cost advantages over titanium, but still a step above straight Al; Primary competitor to CF/Epoxy
	Ceramic Matrix Composites		*GE Next Gen Engines*	*Engine Hot Static & Rotating Components*	Require high operating temperatures to achieve desired properties – *likely few aerostructure applications*
	Titanium Aluminide		*GE9X*	*Engine Hot Static & Rotating Components*	Also candidate for 3D printing; primarily an engine competitor with CMCs

These Factors Suggest Next Wave Of Supply Chain Rebalancing May Come Later Next Decade

Automation?

Where it addresses costs

BOEING



Ultra Rapid Air Vehicle

Maybe After 2030

AIRBUS

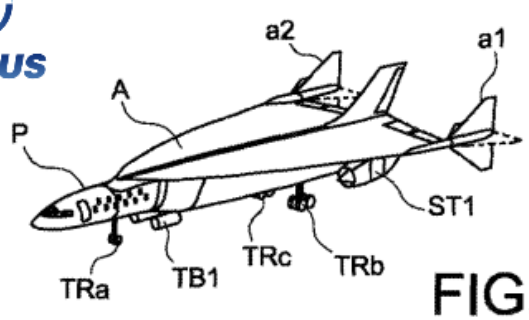


FIG. 15

- Well defined outlook for materials, and smaller market niches targeted by likely new platforms
  - Automation favored by higher rates to amortize investments
  - In addition, High Rate programs will present a greater challenge to current production methods for composites, regardless of design outcomes
- Appetite for radical new platforms also point to more incremental change as well
  - Boeing "no more moonshots" approach – *perhaps this changes under new leadership?*
  - Airbus "no new airplanes before 2030"
- Aircraft size relevant to supply chain possibilities
  - Middle of the market planes have volumes amenable to supply chain approaches of A350 and 787

OEM Supply Chain Strategy Evolution Will Continue To Shift Supply Chain Relationships

- Trend towards outsourcing and "OEMs as Integrators" has reversed
  - Boeing acquired meaningful parts of its own 787 supply chain, and continuing insourcing on 777X wing and 737MAX nacelle inlets
  - Airbus has continued to hold Premium Aerotec and Stelia (Aerolia + Sogerma)
- Consolidation at the raw materials level is leading to greater OEM focus across supply chain tiers
- Leveraging strong legacy positions, major Tier 1 suppliers will likely continue to be able to secure sizeable positions
- *Combination of these factors will challenge Tier 2 and smaller Tier 1 suppliers*

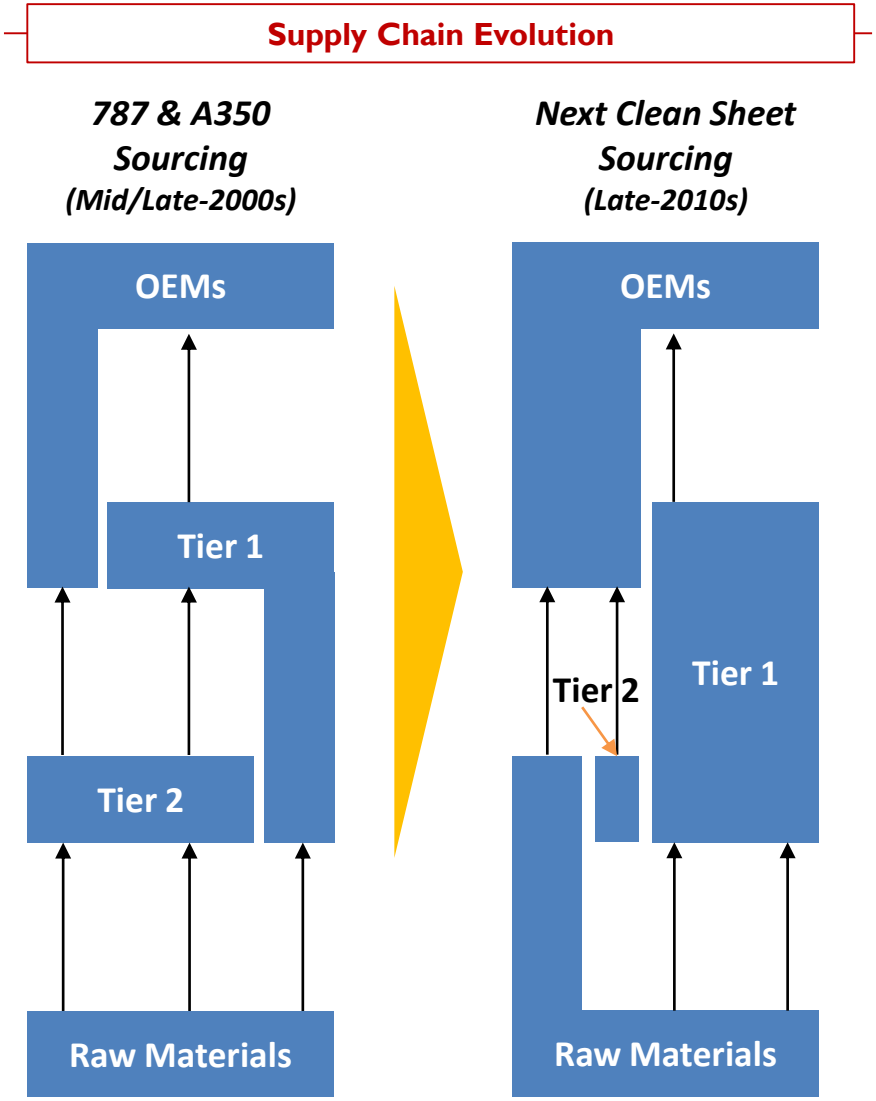
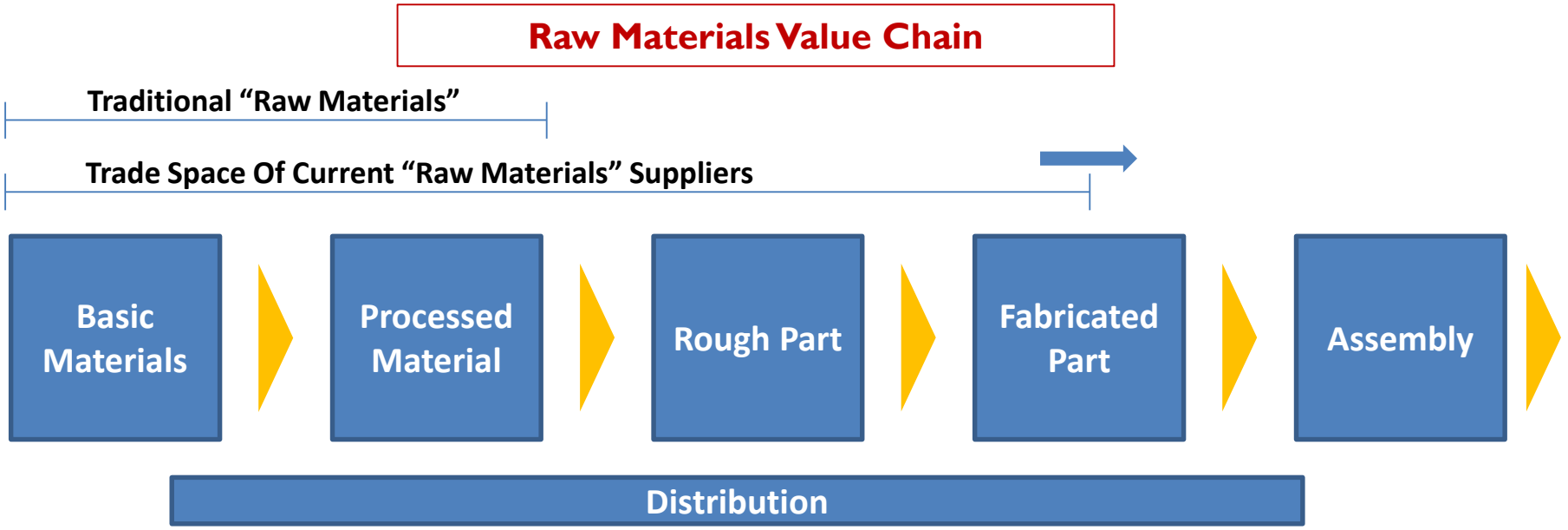


Table Of Contents

"Raw Materials" Becoming A Less Well Defined Part Of The Value Chain



- Consolidation has led raw materials providers to combine across material types, and to take a greater position in engineered solutions
  - Few instances do date, however, of metals raw materials suppliers joining with composites suppliers
- Near net shape castings reducing absolute remaining value add in fabrication, while composites have often served to eliminate sheet metal fabrications
- As links in the value chain are consumed, Distributors are in a more challenged position
  - Potentially less so when adding value to materials or as a 3PL inside a supply chain

Raw Materials Suppliers And Distributors Likely To See Greater Cost Emphasis In Coming Environment

CUSTOMERS

- Customer ***consolidation will favor larger raw materials suppliers*** and larger contracts
  - Likely consolidation of both buying authority and (to a lesser degree) physical locations
- Larger contracts, more sophisticated customers, and greater OEM scrutiny will ***challenge margins***

CAPABILITIES

- The materials used in the next five years likely to continue to be the majority of the market in the five that follow
- ***Moving up the value chain*** will be good if it opens opportunities to be valuable to bigger customers (and doesn't alienate too many smaller ones)

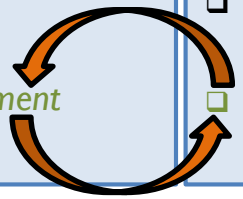
NET ASSESSMENT

- Next decade will be characterized by more incremental evolution in the supply chain compared to the last ten years
- A much bigger and more radical supply chain shift is likely later next decade as high rate platforms come to market
- Being a bigger raw materials player is good now, and will be (relatively) better in the future

Investing Resources In This Market Environment

Levers For Growth

INNOVATION	PRODUCTIVITY	SCALE
❑ Incremental	❑ Cost ❑ Availability/Velocity	❑ Often an enabler of productivity ❑ Acquisitions have become increasingly expensive ❑ Growth beyond current value chain position
❑ *Likely to see reduced investment*	❑ *Area for increasing investment*	❑ *Area for increasing investment*



- ❑ Substantial, radical innovation unlikely to see broad adoption in the next wave of new designs, while incremental improvements that are easily incorporated will be helpful
- ❑ Investments into productivity, however, are likely to yield competitive advantages
- ❑ Scale can reinforce productivity, or offer the chance to propagate successful productivity improvements

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- We offer flexible, value-driven service models that help clients drive results while maintaining budget discipline

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