“Alcoa Aerospace – Optimized Solutions Meeting Mission Requirements”
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Good afternoon, ladies and gentlemen.

It is my pleasure to be here with you today.
My goal is to bring you up to date on Alcoa’s progress on our announced 20/20 cost and weight reduction goals versus composites. Along the way, I hope you will also take note of our rapid evolution from the role of materials supplier to that of a creator and provider of optimized solutions to help our aerospace customers meet their mission requirements.

I believe it is safe to say that there is a metamorphosis happening within Alcoa Aerospace today. It has been brought on certainly by the competitive realities of the advanced materials industry. But, it has been equally sponsored by two other very important forces … the broadening of Alcoa’s aerospace product portfolio and the advancements registered by our technical community over the past decade. Alcoa is broader solutions-wise and deeper technically than we have ever been.

I hope that you will agree at the conclusion of my remarks that it is a time of accelerating and productive advancement in Alcoa Aerospace.

In 2002, at this session as a matter of fact, Alcoa announced our intention to reduce the cost and weight of its products by 20% in order to defend the position of metallic aerospace structures against composites.

At Paris in 2003, Bill Christopher our Executive Vice President of Aerospace, repeated this intention. He added that Alcoa's aerospace product and technology portfolio had also been significantly strengthened by the addition of Howmet Castings … now part of a larger business called Investment Cast and Forged Products … and the creation of Alcoa Fastening Systems. He also began to talk about Alcoa's aerospace strategy in terms of meeting OEM and airline requirements. In short, he introduced Alcoa Aerospace as a solutions provider as opposed to a materials supplier.

Today, as a former OEM structural technologist who has worked for more than two decades to understand airline needs and to build aircraft meeting them, I hope to add my own perspective too this narrative.

I'd like to begin by sharing some important conclusions gleaned from our work during the past two years.

First, Alcoa Aerospace remains totally committed to meeting our goals of 20% cost and weight savings. Based on what we have achieved so far, I am convinced these cost and weight targets are within our grasp.

Second, our work has convinced us that advanced alloys, hybrid structural materials, innovative design concepts and novel manufacturing and assembly techniques are the key enablers for meeting our goals. Their seamless integration is essential for achieving our weight and cost objectives.

Third, that Alcoa's chosen path of providing optimized solutions tailored to meeting specific aircraft mission requirements is the way to not only maintain, but expand the role our aerospace products will play in the future.

And fourth, if it requires a new generation of hybrid structural materials to satisfy OEM and airline demands, that we are both ready and capable of moving forward along this front, as well.

From my perspective as a former Airbus employee, Alcoa has adopted a strategy that is competitively practical, technically creative, commercially and solution focused. It is focused on helping OEMs meet airline demands for fuel burn, payload and range, weight, repair and maintenance, and affordability.

By practical, I mean that our strategy is focused on closing specific performance gaps against composites in major aerostructural applications while simultaneously improving the performance of existing metallic products.

By technically creative, I mean that we are focusing our scientific and engineering building blocks on meeting the technical demands facing new materials and manufacturing processes. In the case of materials, we are developing advanced alloys and product forms with respect to structural design requirements. We are improving cost efficiency and material utilization. In the case of manufacturing, we are addressing the sizing and scalability of components and subcomponents, the complexity of their geometries, tooling costs, lead time and process duration as well as quality requirements.

By commercially focused, we understand that aircraft operating and in-service performance are our customers' most important goals, and therefore our own. We realize that windows of opportunity for costs open only after performance requirements are met.

And, by solution focused, I mean that we have already realized the role that hybrid structural materials must play in the future and are adapting them to meet our performance and cost targets where they add value.

I would next turn to a brief review what Alcoa perceives to be the realities confronting commercial aircraft OEMs today. These realities are so important because they provide the framework for our technical endeavors.

- The needs for less fuel burn, more payload and longer range are undeniable.

- Fuel prices are adding ever greater importance to weight savings.

- Demand for environmentally-friendly aircraft is adding to the importance of improved fuel efficiency.

- The extension of inspection intervals is driving requirements for higher damage tolerance, reduced crack growth and large damage capabilities.

These realities mandate that there is no way to pay a weight penalty with a cost savings for future generations of aircraft.

How do these commercial realities translate into Alcoa's technical imperatives?

First, they tell us that metallic structures must operate at higher stress levels. They tell us we need advanced alloys that are capable of meeting static load requirements matching composites.

They tell us that new approaches must be developed to meet demands for reduced crack growth and improved residual strength.

They tell us that we need to tailor hybrid structural solutions and integrate them for selective reinforcement, damage containment and stiffening.

They tell us that materials and manufacturing costs at the component level must be considered seamlessly to keep our solutions competitive.

And they tell us that Alcoa's ultimate objective must be to develop damage tolerant materials and structural solutions.

To reiterate, Alcoa realizes that the only way to create optimized solutions is through the seamless integration of advanced alloys, hybrid structural materials, innovative design concepts, and novel manufacturing and assembly techniques. We also realize that the key enabler of these solutions is collaboration with OEMs.

Here is a snap shot of our current efforts around advanced alloys and products:

- Structural solutions with improved strength, corrosion resistance and damage tolerance;
- Low-density alloys, such as aluminum-lithium and aluminum-magnesium-scandium;
- Weldable alloys;
- Property improvements for thick products;
- Integrally-stiffened products; and,
- Monolithic structures.

From the standpoint of hybrid structural materials and innovative design concepts, here is where we are focusing:

- Selective reinforcement to improve damage tolerance; and,
- Tailored stiffeners and damage containment features to improve large damage capabilities.

Our novel manufacturing and assembly techniques currently include:

- Advanced joining techniques, such as friction stir welding, laser welding and adhesive bonding;
- Advanced fastening systems;
- Age and creep forming;
- Large structural castings and forgings; and,
- Structural health monitoring

After this brief review of what we are doing, let's turn next to the hows of our efforts … our process for creating optimized solutions. There are three elements that focus and enable our efforts:

- our criteria for solution competitiveness,
- our technology development process; and,
- the tools and building blocks we employ to execute the process.

These must all fit together for us to successfully combat the tyranny of time and meet our customers' requirements for industrial readiness.

The criteria we use to select the most competitive solutions effectively combine commercial reality with practicality. They include:

- Aircraft Performance – range, payload, fuel burn, cost and weight dominate our thinking;
- Technology Leadership – does our customer want to be on the bleeding edge, leading edge or are they looking for solutions ready that are ready to implement;
- Success on Current Aircraft Families – can we validate our solutions through demonstration, what is their potential for on-going development, are they scalable to future aircraft;
- Design Principles – are they existing or still to be determined;
- Mitigate Risks – high to low;
- Industrial Operations – can our solutions fit into current manufacturing procedures or will processes be required to put them into play; and,
- Service Readiness – are our solutions ready for certification, can our products be inspected easily and repaired efficiently.

Alcoa's technology development process effectively combines commercial reality with creativity. It is an iterative process that follows this path:

- Develop and Rationalize Concepts and Technologies – what are our customer's design requirements, material needs and manufacturing concepts;
- Screen Concepts – we have developed the capability of conducting trade studies integrating various design, weight and cost options for wing, fuselage, flat panel and compression-optimization concepts;
- Concept Evaluation and Testing – our next step is to evaluate options with customers, prepare and test coupons and articles and analyze the results; and,
- Large Panel Testing – the final step in our technology development process is to bring the most comprehensive data we have to the table from large panel tests to evaluate the feasibility and select the best solution to pursue. This of course is also done with our customers.

Our tools and core enabling technologies effectively combine technical creativity with the freedom to optimize our solutions to meet the customer's specific performance requirement. Our goal is to assure our customers they will not have to compromise their options to meet the mission performance objectives of their aircraft.

The resources that help us achieve this goal are:

- Market Sector Teams that integrate Alcoa's internal capabilities across all aerospace businesses – from aluminum to super alloys to fastening systems;
- Integrated Product Development Teams that bring Alcoa's metallurgists and materials scientists, trade study, structural, corrosion, fatigue and durability experts together with OEM, Tier 1 and external technologists to make sure our solutions fit with airframe design and structural requirements, industrial needs and systems integration.

Alcoa's core enabling technologies provide the bedrock for everything we do. They are:

- alloy development;
- thermo-mechanical processing;
- material evaluation and characterization;
- advanced manufacturing technologies; and,
- the rapid design and trade studies I mentioned earlier.

With this background, we are now ready to take a look at Alcoa's optimized solutions for wing and fuselage applications.

Let’s begin with wings. Our wing design concepts are focused on tension-loaded lower wing skins and stringers and on compression-loaded upper wing skins and stringers. Our design scenarios include advanced alloys with improved material properties, selectively-reinforced, fiber-metal laminates in conjunction with selectively-reinforced and friction stir welded, integrally-stiffened panels for upper wing covers. Performance requirements include static strength, damage tolerance and spectrum loading, and residual strength. Simplified design and trade studies have been conducted comparing the weight and performance of each of these structural solution concepts.

Our trade studies have shown distinct advantages for each of these various scenarios, including higher stringer modulus, reduced stringer density, improved skin properties and higher stiffness.

In addition to these performance enhancements over our baseline, which is the A380-800 technology, we have also calculated weight savings of more than 5% when using advanced alloys alone, more than 9% when advanced alloys are selectively reinforced and up to 13% when fiber metal laminates are used in conjunction with advanced aluminum-lithium stringers.

Risk increases with the technical readiness of each design scenario. However, I can report that Alcoa believes that we can eliminate the weight gap against composite wings by combining hybrid materials with advanced metallic stringers at minimal risk. We are currently evaluating these design scenarios with our customers. We expect we can implement our most advanced concepts step-wise over the next 3 – 4 years.

Moving next to the fuselage, our solutions integrate advanced alloys and hybrid structural materials with new structural design concepts. We are also evaluating advanced manufacturing techniques along with assembly automation. We see the integration of these options as the best way to meet customer needs.

The fuselage performance requirements we have been using include axial as well as hoop loading in terms of circumferential and longitudinal cracks. Our most advanced fuselage design concept combines selectively-reinforced, advanced alloy integral skin, stringer and frames with integrally-stiffened panels assembled via advanced manufacturing technologies, including robotic welding for lower fuselage panels.

So far, we have evaluated several fuselage scenarios against a baseline metallic structure. We have developed one solution that we believe will achieve our 20/ 20 targets. As you see, we are addressing several different performance requirements simultaneously, including structural performance, manufacturing costs and corrosion resistance.

I mentioned earlier that one of Alcoa's strengths is that we are taking a very practical approach to closing the performance gap against composites. One of the key elements of this practical approach is focusing on continuously improving the performance of existing metallic products. I'd like to take a quick look at three techniques we are using in this regard – selective reinforcement, damage containment features and integral stiffening.

Selective reinforcement enhances performance by riveting and / or bonding crack resistant straps to improve damage tolerance, crack growth and residual strength. We are proposing this technique in a number of applications, including conventional, built-up panels, laser welded panels, integrally-stiffened panels and friction stir welded, integrally-stiffened panels.

Selective reinforcement test results at the coupon level have shown fatigue crack growth stress allowable increases from 10-45%, residual strength increases of 25-40% and a potential weight savings in applications in the lower wing and fuselage.

Damage containment features are being validated in the laboratory today. Our goal is to developed unique approaches for retarding crack growth to improve inspection intervals.

Compared to a baseline, built-up, lower wing cover, a selectively reinforced panel featuring damage containment features shows a 25% improvement in crack growth and a 15% improvement in residual strength.

The same magnitude of improvement can be seen in integrally-stiffened panels. These panels present significant manufacturing cost saving opportunities. They reduce weight by requiring fewer joints and fasteners. Integrally-stiffened panels are scalable via friction stir welding and are also age-formable. And they offer our best buy-to-fly ratio.

I began by stating that I thought Alcoa's aerospace strategy was competitively practical, technically creative, solution and commercially focused. I hope I have shed some light on why I believe all these things to be true.

I hope I have also convinced you that our vision of optimized solutions, achieved by successfully combining advanced alloys, hybrid structural materials, and product, innovative design concepts, and novel manufacturing and assembly techniques, are within our reach as we work with our customers to achieve their aircraft performance, weight and cost objectives.

Alcoa's 20/20 objectives will be achieved via the application of advanced alloys, manufacturing and assembly techniques. My belief is that even greater reductions are achievable as we develop and apply advanced alloys and hybrid structural materials, automated manufacturing and assembly technologies with systems-level solutions for future generations of aircraft.

I would like to conclude this afternoon by announcing that we are adding a third element to our 20 / 20 targets. The new element is maintenance cost reduction. We intend to achieve this by working with our customers to achieve longer inspection intervals. Our solutions in this area will include the introduction of structural health monitoring.

Alcoa Aerospace has successfully molded its high-level goals into just three areas – help our customers meet their performance targets, assure that our customers maintain their technical leadership and help our customers sustain their shareholder value. If we can do these things, we will not only sustain, but expand the role of Alcoa's aerospace products.