STEVE MILES: So in the interest of time and to keep going, our next speakers are in the aeronautic space. And we have Alan Thorne, who's the manager of the Manufacturing Automation Program at Cambridge University, who will be our next speaker. And as I think was mentioned-- and Ken, actually, do you want to come up and sit on the panel here? As was mentioned in the beginning of the session, this is the example of a market opportunity that looks like it's going to require a higher level of academic collaboration, and then with our standards organization and so on, to ensure that the aircraft parts industry comes up to meet the kinds of requirements that the OEMs are placing on the industry.

ALAN THORNE: Hello, everyone. My name is Alan Thorne. I'm actually one of the associate directors at the Cambridge Auto-ID Lab in the UK. I'm afraid one of my colleagues, Duncan MacFarlane, was going to be here today and speak to you, but he couldn't make it. So making up for that in [? gray ?] [INAUDIBLE] is Ken Porad from Boeing, who's going to be talking at the end of my presentation about some of the industrial requirements in this area.

So the kick off in this [INAUDIBLE] today, basically I'm going to go over the aim. What we've been doing is putting together a research forum to help with the adoption of RFID in the aerospace sector. So I'm going to go over the aim of that work, some of the background work we've been doing, the development of the research consortium, the research themes that we've been looking at, and then we'll move over to Ken to get Ken's view on some of the industrial requirements and how the research program is feeding into his work.

So the aim of the program is to remove barriers to widescale automated ID deployment in the aerospace sector through timely and effective R&D-- a noble goal. And that's one of the things I do want to point out here-- is we're looking at ID technology. So we're not specifically looking at RFID, because one of the things we have found in the aerospace sector is there's going to be a number of ID solutions that we'll be using. And we have to think about which appropriate ID technology works for which particular solution.

So if we look at the background, I mean, the Cambridge Auto-ID Lab is based at the engineering department in Cambridge, we have a lot of work going off into the aerospace sector. And there's been a lot of requests to understand how our RFID work could impact some of the aerospace work that's been going on. And the aerospace companies we've been speaking to over the last few years have been thinking quite broadly about how RFID would affect their business across a wide scale, all the way from the production level, right through to end-of-life information about products. So that made it quite exciting to us as a research area to be tackling.

There's been many one-off trials using 1D and 2D barcodes, and RFID as well. And really, it was recognized quite early on that it wasn't going to be just a simple case of taking knowledge from the fast-moving consumer goods area, and moving out of into the aerospace sector. There were some definite differences there. And one of the quick ones you can see here is the aerospace industry is very much interested in what happens to a product during its life phase, rather than up to the point of sale, which we find in the retail area.

So there's been numerous industrial trials and activities going on, and I've listed just a few here. But you can see that Boeing, Airbus, General Electric, BAE systems to name a few, have been really diving into this work. And of course, the standards development area is really pushing ahead as well. We've got EPCglobal looking at how the EPC network will support this area, as well as organizations, such as ATA, [? SETA, ?] and IATA.

And of course, there's been a number of industrial forums, such as the Aviation RFID Forum run by Boeing and Airbus, as well as *RFID Journal.* So it was recognized that there was really a need for a research program to help with the adoption of this work. And really, it was to add some research rigor behind some of the activities that were going on, as well as provide an independent research body to support solutions and development of some of the standards for work to go towards the standards area.

So I've just listed here a few of the key differences that you can find between the retail sector and the aviation sector. If we look at product lives, you find that in the retail sector, most of our products, [INAUDIBLE] we can measure in months. Whereas in the aerospace sector, we find that many of the products are going to be out there between 20 and 50 years. So we're going to actually be capturing a lot more information about the way these products are used. And of course, the technology has to last the lifetime of that product. So we're looking for much more robust technologies to be used there.

Product characteristics-- we find in the retail sector most of the products are low value, low complexity items, whereas in the aviation sector, we find that they're high value, high complexity items, where we can start to look at using more expensive technologies, such as expanding into some of the active technologies and the more sophisticated tag classifications that will give us more information about these products. Key application areas-- in the retail sector, it's mainly been focused in the logistics area. In the aerospace sector, we're really looking at how the product's being used-- lifecycle information, repair services, [? spares ?] management, as well as the logistic services. And of course, environmental conditions-- the environmental conditions in the retail sector are actually quite nice compared to in the aerospace sector. It is quite a harsh environment that these parts are going to be used in.

So we went about setting a research consortium together to support some of this work. And we started it off in December of 2004. And this was really going around, getting industrial consultation to understand what the requirements were. So in April 2005, we announced that we were going to be putting together a program, and then we started on the background work for that program-- background investigations, membership process. So this is an industry-sponsored program, getting members to join the program, and of course, forming a core research team that would be working on it.

The program has just been launched. It was launched on [? the ?] 9, 2005, basically, at one of the Boeing facilities. And really since then, we've been moving into initial scoping activities to understand the research area more widely. Those research scopes are going to be delivered, actually, at the beginning of February.

Our next meeting's in London on the 1st and 2nd of February. Then we'll be launching into the full research program. And of course, the important thing is to make sure that these industrial requirements are getting fed back into the program as it continues on.

So to give you an idea, the industrial consultation meetings that we've been having, the initial one was in Cambridge in December 2004, with [? MBNA ?] in Germany and DaimlerChrysler in 2005. And of course, we did quite a lot of work at the Paris Air Show. So this is really consulting with the industry and finding out what their needs were and requirements. And the kind of people we've been working with are airframe manufacturers, parts suppliers, airline organizations, aerodefense organizations, the Ministry of Defence, maintenance service organizations, and some light aircraft manufacturers, so as to get a broad feel of the kind of requirements that were needed.

The kind of organizations we're involving in the program-- again, it is an industry-funded program. We have end user membership to the program. We have technology membership to the program.

And of course, we have standards bodies involved in the program, as well as the research side, where we are using the Cambridge Auto-ID Lab. It is primarily managing the program as such and adding its research activities to it. Auto ID labs-- the rest of the auto-ID labs are supporting us in this work, and providing their research skills as they fit the needs of the program. And of course, what we're also doing is looking for other research organizations to help us out, where they got specific skills or add to our activity.

So to give you an idea of some of the labs that are helping us out at the moment, the Korean Auto-ID Lab is keen to get involved, as well as the Japanese Auto-ID Lab has been very hard at work on this program. And we've got two other labs that are becoming pushed by the sponsors, if you like. So UNICAMP in Brazil is a university that is sponsored by Embraer, an aviation organization in Brazil, who are keen to work with us, as well as Magdeburg, one of the front [INAUDIBLE] in Germany who works with Airbus. So to give you an idea of who our sponsors are at the moment, the user sponsorship, as you can see, technology membership, and the standards bodies involved.

So the way we've been moving forward with this is, each member that joins the program gets a vote on the themes and the way the program goes forward. And basically, everyone, what we do is we take these initial themes that we found. We present on them. We allow the membership to vote on how they would like to go forward, and which themes will be taken on.

What we do have is a governing body to ensure that any disputes get resolved. And the governing bodies really been pulled together from the end user membership of the program. So that's to make sure that we're still [? in there ?] meeting the requirements of the aerospace sector, and not necessarily just meeting technology vendors' needs. So the program structure is, we have a bunch of research teams that we're working on, and we're pulling organizations in to support the research work in those different areas.

So the kind of research themes that we're working on come out as ID lifecycle management, application matching, sensor fusion, security, track and trace, and data synchronization. So these are key areas that have been identified by the aerospace organizations as being important research tracks that should be solved to help with the adoption of this technology. So lifecycle ID management, the background of this is we're finding that a product can have a number of identities in it. It can have a number of databases or data repositories within a system holding information on it.

So for example, it can have production information about it. It could have maintenance information about it, and it could use this information about it. As components in that product get changed, how do we thread together this information to maintain information throughout the product lifecycle of that part, which is quite an important issue. And we've got a number of industrial collaborators that are working on that program.

ID application matching-- again, as I said before, RFID is not the only ID solution. And there is actually going to be a number of ID solutions used in the aerospace sector. If we look at people like Rolls-Royce, they're very keen-- they use data matrixes on fan blades for identifying them. It's a way in which they can uniquely identify fan blades. So we've got to deal with a mix of IT technologies.

What this work here is looking at is different processes within the aerospace industry and understanding which ID technologies fit most appropriately to those needs. Once we can do that, we can start to understand the different ID technologies that we use in different areas within a particular process. And we can work out which would be appropriate technology or best match across the different processes that that part or product has to go through. And again, we have a number of industrial collaborators working on that.

Sensor fusion-- this is coming through health care monitoring on aircraft. So we're very interested in knowing how we can best use sensory information that comes from aircraft systems, as well as ID information that comes from parts that are in that aircraft to make best decisions on has there been a problem with the aircraft or future maintenance that has to happen on an aircraft? Or is there a failure mode about to occur?

Data synchronization-- we're finding that, on many of the applications, it may be that the product might not be in a networked environment. So we might have to store information locally on the tag for a number of processes, or it might be that it's a safety-critical kind of information that has to be stored on the tag. So how do we deal with products that are moving in and out of networked environment, and making sure the data is updated in an appropriate way, and the correct synchronization processes are happening so that's another very important research topic that's been brought forward.

And of course, track and trace-- as in many different areas, track and trace is very important in the aerospace sector. I mean, it's a legislative requirement to provide good track and trace of aerospace parts. So currently, we've got some scoping activities, understanding what the legislative requirements are, as well as the business needs in the aerospace sector for track and trace, and thinking about what the future will be of track and trace.

And everyone's in agreement. Basically, the security is an enormous here that has to be covered. And really, this hit all of our research areas that we've been looking at.

So we can see here, in this diagram here, I've tried to show from right down at a hardware level up to the business level on the left-hand side, and the different research topics we're working on. You can see that there's quite a good match. We're hitting quite a few of the areas with the research topics that we're looking at.

And you can see on the far right that actually, security goes across a whole bunch of those research teams that we were investigating. And actually, our security work team is working quite well. That's now moved into an industrial work team that are actually looking into that work right now.

So deliverables are coming out of the program-- tools to support deployment analysis, guidance on pilot results, guidelines on complex requirements, demonstrations to clarify applications and issues, software prototyping, and white papers. And for our next meeting that's going on on the 1st and 2nd of February, we've got a number of industrial white papers that are coming out on each of these research topics. And these are basically the scoping activities that have been going on for the last few months.

So to give you an idea of some of the current research team that's involved in the program, basically what we're looking for here is really to find research organizations that are interested in getting involved in some of these areas. And it'd be very good if you could get in touch with me to talk further about how we could collaborate on this program. So that covers what we're doing as putting together a research program for this area. What I would like to do is move over to Ken to allow him to talk about some of the requirements that Boeing and his vision for where some of the commercial aircraft activities are going. Thank you.

[APPLAUSE]

KEN PORAD: Are we going to take a break first?

ALAN THORNE: What did he put here?

KEN PORAD: Good afternoon, everybody. My name is Ken Porad. I'm the Boeing engineering representative to the Air Transport Association [INAUDIBLE] automated identification and data capture. And I'm leading the effort at Boeing Commercial Airplanes to get RFID-enabled shipping labels all over our factory to reduce unit cost, cycle time, and defects, and also on shipping labels and packing slips, and on airplane parts. And Alan asked me to talk about some of the progress on deploying RFID on the airplane parts, because it's the most exciting and it's the most complex.

I want to start with how we do business today. In commercial aviation, we have barcoded nameplates to identify products on the airplane. And typically, there's three elements of data that are on these nameplates that are a pointer to a global database of unlimited information about the life cycle history of that product. And we use a unique serial number within a manufacturer's code and a part number. Those three elements today define uniqueness to an airplane part.

And there's a problem with that. The problem is that's a static device. So once it's printed, that barcoded name plate, that's the way it is for 20 or 30 years.

And in my industry, we change our numbers to make it more complicated. Any time that we add a service bulletin or a mod kit to improve reliability of an airplane part, if we change form, fit, or function of that part, we have to roll the part number. So you can imagine, what's up on the screen, if this identifies the product on an airplane, that lower nameplate, that's good for 30 years. That's the Social Security number of a part.

And you'll see that there's a unique serial number and a manufacturer code. That's in human-readable text in English, and it's also in a barcode. That upper nameplate has the supplier's part number. That supplier's part number of changes over time-- sometimes many times over the years.

So what we do today is we have to install a revised upper nameplate in a service bulletin or mod kit, so any third-party maintenance provider worldwide could install this on any Boeing customer's airplane without linking it to a specific serial number to end item. So you can imagine the logistics challenge it is. You can imagine the benefits for RFID.

Let's talk about benefits. A lot of times, when we present, we have Airbus with us. Airbus, as you know, is our major competitor. But they're not our competitor to implement standards initiatives. You may not know that Boeing and Airbus share 70% common suppliers.

So to provide inconsistent requirements and direction to common suppliers would be costly and foolish for Boeing and Airbus. And what's worse would be to have an inconsistent solution to a common customer that flies a mixed fleet of Boeing and Airbus Jets. So we've been working with Airbus for 10 years now, first to deploy barcoded nameplates, and now on RFID. Without spending a lot of time on the benefits, this is worth a lot of money to Boeing. As I said, we're going to be putting RFID-enabled shipping labels on packages incoming to Boeing.

Just in Boeing Seattle, we get 50,000 packages per day incoming to support the production of an airplane program. So 50,000 per day. If you want to know about the business case, today, we have nine linear barcodes on each box. So nine times 50,000, that's 450,000 times someone has to read a barcode.

In Wichita, Kansas, we set up a portal that incoming receiving, and we pushed palleted shipments from all of the logistics providers like FedEx and UPS and DHL. They'd all just come right into our incoming or receiving door, or at our dock door, and go right into our ERP system. That was worth millions right there. I'm not allowed to tell you the exact numbers, but they're huge.

Also in our factory, reducing cycle time unit costs and defects. You probably know there's six million parts on a jetliner. We're not going to be putting RFID tags on all six million parts, but I will show you what we have planned for.

Another major benefit for Boeing is that this information that we're exchanging with our partners, our airline customers and our suppliers, this is helping us reduce the cycle time to solve problems that occur. The airplane is one of the most complex products ever created by man. And as there's growing pains when we introduce a new product, there's a lot of technical problems. And before, it would take up to 18 months to fault isolate why these problems are being caused and to get a technical fix deployed into the field.

With RFID, we think we'll get sharing of information to reduce that cycle time down to three months. All these other benefits up on the screen provide accurate as-delivery configuration helps us with warranty claim processing, helps airlines track their rogue units, helps reduce the risk of suspected unapproved and counterfeit parts. This is all going to be very wonderful with RFID that barcode could not really do.

The way this is going to work is that, when we create the airplane, we develop a birth record. That birth record has the serial numbers and part numbers. We turn that over to an airline customer. That customer has agreed to tell us all of their flight hours and landings, their unscheduled component removals by part number and serial number, and all their dispatch delays-- their air turnbacks, their cancellations, their delays, cancellations.

We keep track of this through a teradata mainframe, and it's available 24/7 worldwide to Boeing customers using Microsoft Excel as a platform. We've actually been doing this since June of 1995 when we launched the 777 airplane, but we were doing it without auto-ID technology and it was very inefficient. So now with RFID, we're getting very excited on the new Dreamliner to launch this. And we'll get to what Cambridge is doing for us in a moment.

First, I wanted to explain, we're not putting RFID on six million parts on an airplane. It's going to be on the new Dreamliner 2,000 end items-- only 2,000. You're probably wondering why 2,000. Well, they really drive the cost of ownership of a Boeing airplane, those 2,000 parts.

What you see up on the screen is the criteria the airlines told Boeing and Airbus that's important to them to track through a life cycle-- up to 30 years. And they said focus on line-replaceable units. Repairable parts-- not consumables or throwaways, but parts that are recommended as spare, and parts with a high frequency of removal. That drives cost of ownership.

And expensive spare parts-- parts that are on what's called the master minimum equipment list that means. They're dispatch-critical. So if they're not working, an airline cannot put the airplane into revenue service. So they want to manage why they have delays.

Anything that's a life-limited or time-controlled part, like landing gear, that's a great candidate to have an RFID nameplate on, because we're going to be housing the maintenance history right on the nameplate. And I'll show you in a moment how that's going to work. And also, all of the emergency equipment on the airplane will have an RFID tag.

We've talked to many world airlines about this program, even more than depicted on this world map. And they all said this is of high value to them. There's a very big return on investment in commercial aviation for RFIDs.

Unlike in our factory, with supply chain management and logistics, when you put these on the airplane, you have to worry about continued airworthiness and safety of flight. And Boeing has to certify to the regulatory agencies that we do not impact any installed system or equipment on the airplane, because these RFID tags, even as to identify a nameplate, the FAA considers this a transmitting portable electronic device. And as such, typically, we have to demonstrate through a failure mode and effects analysis that the probability of a single point failure bringing down an airplane is 10 to the minus 9th.

What we've done it Boeing is that we decided to do some in-service evaluations instead, which I'll show you in a moment. But this is the official Boeing engineering position on passive RFID on one of our jetliners. And this is for an existing, currently in-production jetliner, or our new Dreamliner.

We're saying that for passive RFID technology, because there's no on site power source and no active transmitter and our schema is to use this while the airplane is parked on the ground, not on an active taxiway and not in flight-- and we have adequate electromagnetic shielding on the Boeing airplane today, and we're going to use part 15 certified unlicensed use FCC rules, we believe that passive devices do not impact form, fit, or function of any installed system or equipment on a Boeing airplane. And we've got already the FAA, JA, EASA, Air Transport Canada to agree to this. In fact, we received on May 13 a National Policy Memo from the FAA allowing passive RFID tags we put on Boeing jetliners. So that's the basis for the new airplane, the 787 Dreamliner.

To prove that this worked, we wanted to do a proof of concept. And we picked one of our good customers, FedEx, who had an MD-10 going through the conversion from a passenger plane to a freighter. And we got to do a science project.

For the first time in commercial aviation, we outfitted the airplane with passive RFID tags in all zones-- the flight deck and the wheel well, the avionics compartment, the E&E bay, and the cargo compartment. And we flew this airplane 18 hours per day, multiple flight segments per day, out of Memphis, Tennessee, for 90 consecutive days. And we also left the tags on for one year. And I'm here to tell you, there was not one failure.

Here are the objectives as officially stated. We wanted to identify any potential electromagnetic interference or any detrimental environmental effects. As you well know, there's a lot of changes in temperature, pressure, humidity.

There's caustic chemicals, like skydrol, which is hydraulic fluid. All these can affect the performance. There's also quite a bit of metal in the airplane. So we wanted to evaluate the integrity of the application to make sure none of the data got corrupted over time.

This was our test coupon. You'll see a standard barcoded nameplate with human readable. This complies with the Air Transport Association Spec 2000 chapter 9 standard. What you don't see inside is a laminated inlay, which is the microchip with the antenna package. On the back of this device, we had iron-loaded silicone, which is to make this work directly applied to metal, so there wouldn't be interference.

We ran this test twice. The first test we did with 13.56 megahertz, using an inlay from Infineon technologies in Germany, with a 10,000-bit EPROM. That test worked fabulously, but it had one limitation.

The read range was, like, 6 to 8 inches in the airplane-- 6 to 8 inch read range. And that didn't fulfill the vision we had of walking through the passenger cabin, reading all of the life vests, or reading behind side wall panels, devices, or up in the passenger service units, where the oxygen masks come down when you lose cabin pressure of the airplane. So that read range didn't work for us. So we decided, let's go back to the drawing board. Let's go to ultra-high frequency.

So we partnered at that time with Intermec Technologies. They created some inlays for us-- 915 megahertz, metal mount-compatible, and we ran the test again. And at 915 megahertz in a Boeing airplane, we got 10 to 12 feet read range, and it worked really fabulously. We were very pleased.

Here's our test airplane, tail number N370FE We've used it for two tests now-- the high frequency, the ultra-high frequency. And we have plans this year to do the same airplane, the same parts, with active tags.

I wanted to show you some of the applications in the airplane. This is an electronics avionics box. It's in a benign application, where the temperature, pressure, and humidity are relatively constant. This is the inertial reference unit of the airplane.

This is also a temperature-controlled environment. This controls the flaps of the airplane. It's in the left wheel well. It's a pretty caustic environment, actually.

This is the smoke detector. This is on the ceiling of the cargo compartment. We did every other smoke detector of the airplane. This was in the right wheel well.

This is a Vickers hydraulic pump. It runs the hydraulic system on the MD-10. This is the handheld products portable data terminal that the mechanics at FedEx use to read and write to these devices during the test.

What's interesting about this device is that it reads barcodes. It reads and writes RFID. It takes a digital photograph, and it will send this through an 802.11b wireless LAN network. The United States Postal Service just ordered 350,000 of these, so that's your Insider trading tip of the day. I didn't say that.

Findings of the evaluation-- there was no detrimental effects, and there was no suspected electromagnetic interference. And so the FAA gave us the go-ahead as the new basis for our new airplane, the Dreamliner. So on October 3, we made the announcement. Significant line replaceable units on the Dreamliner-- 2,000 of them, actually, will have passive UHF RFID.

We're calling them just ubiquitous term smart labels. But it's going to have human-readable barcodes and between 860 and 960 megahertz a global interoperable frequency. And I'll get to a moment the requirements, but ISO 18000-6C air interface protocol. I'll show you those requirements in a moment, but it's official. The Dreamliner will be the first Boeing platform to have RFID-enabled smart labels on significant parts.

We're not just focusing on parts identification. Like I said, the shipping labels and packing slips, we have a team that are about 90% done. That will also be EPC class 1 gen 2. We've already decided that.

Boeing actually joined EPCglobal last quarter. I will become the co-chair of the Aerospace and Defense Business Action Group for EPCglobal. That was announced yesterday by Mike Miranda.

As far as the total integrated automation of our airplane final assembly, we're experimenting right now with active tags with real-time locating systems in our factory. And there will be passive tags on returnable containers and tooling also. Finally, we have a new aftermarket process, which is like what's called power by the hour, which will be managing the spare parts business and managing the maintenance for airline customers after we deliver the Dreamliner. And that will be centered around predictive maintenance based on information from the RFID smart labels.

These are the key requirements for the on-airplane tags. It's a passive reader talk first protocol. It's 860 to 960 megahertz. It'll be read/write secure memory. It complies with the text element identifiers and the data syntax and semantics of ATA Spec 2000 Chapter 9.

Here's a rub. We have to pass the DO 160 environmental tests. That's, like, vibration, salt spray, fungus, humidity-- pretty severe testing. That's going to drive the cost of these tags from cents up to dollars-- probably a target price of $15 for an integrated smart label. That's because of the sophisticated test it has to go through.

The air interface is the EPC protocol. These will be metal mount, surface-insensitive packages. We're asking for a 10-year data service life, and it has to comply with the FAA policy memo released on May 13.

We had a meeting at the Museum of Flight in October of last year. We had 40 companies attend. This was all of the people like Philips and Intel and Symbol Technologies and Teleflex.

Everybody was invited, and we said this is what our requirements are. Boeing's a requirements holder. We're a system integrator, a type 2 certificate holder. We do not have a core competency in RFID technology.

Some of the data elements that we're going to be writing to these tags is things like the part number and the serial number, the manufacturer, the date of manufacture, country of origin, the mod level, the weight of the part, the lot number, things like this, many more. This is all being standardized. If you're a supplier to Boeing or Airbus, you'll be happy to know that these requirements are all the same for Boeing, for Airbus, for Bombardier for Embraer, for [INAUDIBLE] Aviation and for Cessna-- for everybody. ATA Spec 2000 across industry global team-- everything's going to be the same.

What we've accomplished-- we've accomplished the passive in-service evaluations. We've held global forums with airline customers and suppliers. They've been held in Hong Kong, in Munich, in Orlando, Florida, and Atlanta. And this year, it will be held in Chicago, and also in Chongming, China, later this fall.

The FAA has approved it. We've got the smart labor requirements defined. We've done our internal studies and our planning directives at Boeing.

We've joined EPCglobal We're forming an Aerospace and Defense Business Action Group. We've joined the Cambridge University Aero-ID research program. We're especially interested in data synchronization.

Planned next steps-- continue this effort with Cambridge on the data synchronization and the sensor networks. We're very interested. We're going to be conducting more supplier forums this year, continue to develop the smart label, more airline forums. We're developing our service-ready plan for the Dreamliner, finalizing our certification plan with the FAA, finalizing the data content and doing an active tag in-service evaluation this year.

But my message to you is that we couldn't do this without academia. Sanjay started this all at MIT, and now we're with Cambridge University. And so Boeing, we're a great industrial concern. But we don't have the competency that you have.

I thank you. Thank you for inviting me here. We're working very closely with you. There's lots of opportunities for continuing working together. We do have time for questions and answers, if that allows, for Alan or myself-- anything about our program.

[APPLAUSE]

AUDIENCE: [INAUDIBLE] [? before we get there. ?] Can you talk about the active testing, what's the purpose of that, why are you interested in doing that? But you said you're using passive labels?

KEN PORAD: We have a plan for active tags on the airplane, where upon demand from the flight deck, they'll interrogate the entire airplane in a broad way. Active tags in our airplane test will broadcast anywhere. They're bouncing off the walls of the fuselage. It's really worked well on our static tests. We want to do a test on an airplane.

Then we can send that information through a high-speed internet link through connections by Boeing to a main operating base on the ground. We've got all these great plans to use RFID on the airplane. That's the next logical step, but we have to get a certified.

AUDIENCE: [INAUDIBLE] flight or [INAUDIBLE]?

KEN PORAD: We're going to do it in flight. You'll know that there's actually a supplemental type certificate that was given to Savvy Technology on a Boeing 767-300 for active tags, and they were the ones for the ULD monitoring. But their supplemental type certificate says it has to be turned off in-flight.

But as you know, they tested that on the United Parcel Service airplane, and they did transmit continuously for hours in-flight every day. So it was a very safe proposition. Next. Sir?

AUDIENCE: Yes, concerning the--

STEVE MILES: Could the you use the mics, please?

AUDIENCE: Concerning this direction of [INAUDIBLE] that you use RFID [INAUDIBLE] manufacturing [INAUDIBLE] flight [INAUDIBLE]. That's different from where you [INAUDIBLE] consider [INAUDIBLE] where you want to [INAUDIBLE] replaceable [INAUDIBLE]. So you mentioned [? that ?] 2009 [INAUDIBLE] different items that you use [INAUDIBLE]?

KEN PORAD: Yes, great question. What I showed was the criteria for the on-airplane part marking that would last for 30 years be on the fly with the airplane-- fly away part of airborne equipment. We're also going to put RFID tags, typically active tags, on large assemblies inside of our factory, so we can find them during our final assembly.

Believe it or not, this Dreamliner will only take three days, 72 hours, to put together every copy. Don't get nervous. Today, it takes up to 26 days, depending, like a 747-- 26 days in final assembly. 737 is a couple of weeks. The Dreamliner, we have a different procurement strategy, a different way of building the airplane. So we have to stage them.

You can imagine, coming from Mitsubishi, Kawasaki, and Fuji [? have ?] industries in Japan, they make about 35% of the airplane. Different parts of the airframe come from all over-- stuff sections. And we're putting the airplane together like a LEGO set.

And so we have to stage them, so active RFID will be all over that airplane. But it won't fly on the airplane. Today, it's these passive tags with that criteria. There was one other question. Thank you

AUDIENCE: So given that Boeing is adopting RFID technology, as well as your mention of Boeing and Airbus sharing some of their manufacturer supply chains, how do you see the NTSB and some of the safety boards reacting to it? What kind of changes do you foresee in the future where I, as an individual, speculate more stringent requirements on aircraft maintenance and safety? But I'm curious what you as the Boeing think tank would feel about lawmakers reacting to these changes as well.

KEN PORAD: The FAA is very pleased that we're going to have maintenance history on the part, as opposed to in a database. But I want to mention, it'll also be redundant. It will be duplicate in a synchronized database that's encrypted and secure. So in case a tag is damaged in service, it can be replicated. That's one of the things Alan's team at Cambridge is helping us with.

What's the most efficient way to get this every day when information around the world is added to these tags about a serviceable [? incorporated. ?] How does it get back to Boeing? And so the information will be in a separate database.

And to your question about the National Transportation Safety Board, they're excited that it helps communicate. Anything to help communicate is what they're interested in. And they're not legislating this. This is an initiative pushed forward by Boeing and Airbus. We're not being mandated to do this.

AUDIENCE: Could I ask one more? How is [INAUDIBLE]? How is your experimentations going to affect your suppliers?

KEN PORAD: The suppliers of the affected 2,000 parts, and that affects about 65 different suppliers to Boeing. Out of our 2,500, it's about 65 suppliers. We've already informed them that we intend to deploy RFID-enabled smart labels on these significant airplane parts, and that this would be a condition of doing business with us. And there's obviously some resistance, and there's what they call cost assertions, where they want us to pay them. And they want some non-recurring engineering money to be given back to them.

So the cost aside, they're all for promoting new technology when there's a business case for them. We're helping them actually understand how this will help them reduce their cost of building products and maintaining them in the aftermarket. Some of our suppliers, they get it. They understand.

Some of them are not going to be early adopters, and they won't be dragged unwillingly. But we have a big enough stick, we can do that. So thank you for-- one more.

AUDIENCE: One quick one. How many times a day will you read this data? You said that--

KEN PORAD: Daily if it's updated. It'll need to be brought back the same day to us. Some of these tags will not be touched for months. They'll only be touched in the event there's a failure.

If there's a no-fault found, there's an indication of failure, the part is removed and replaced. If there's a mandated inspection from the FAA, or if an airline is doing an inventory, they might read the tag, but not write to it. Typically, if they do a service bulletin or a mod kit, or if there's a failure, would be the two most important times they would touch this tag. May go for months.

A lot of things on the airplane have a mean time between removal of over 10,000 flight hours. A typical jet airplane only flies 3,000 flight hours a year. Based on your quantity per airplane, the mathematical model would say that some items won't be visited very often, and some items like coffeemakers have a mean time between removal of every 80 flight hours.

And on a 747, there's, like, 12 coffeemakers on an airplane. So you do the math and they'll be visited frequently, depending on the commodity. Thank you for inviting me. It's been a pleasure.

[APPLAUSE]