EARLL MURMAN: So let's just take stock a little bit on why we're going to do this next module. Did you guys have some troubles with supply chain management in your factories on this last round of simulation?

AUDIENCE: We did.

EARLL MURMAN: We did. And how about the suppliers down there? Did you have a lot of visibility of what was going on with your customers?

AUDIENCE: For all I know, they're building houses.

EARLL MURMAN: They're building houses.

AUDIENCE: [INAUDIBLE]

[LAUGHTER]

AUDIENCE: And not very well.

EARLL MURMAN: And we heard yesterday from Jeff at Gorton's, about how critical his supply chain was in the transformation of Gorton's to a lean enterprise. And we heard also, a little bit at Aspect Medical about supply chain.

So supply chain is a really critical area of a lean transformation. And here's just a quote, that 7% of the companies today are effectively managing their supply chain. Now, that's a little bit out of date. It's 2003. But only 7%. But they're 73% more profitable than the other manufacturers.

So who are some of the companies you think about, you might think about, that are well-known for good supply chain management?

AUDIENCE: Dell.

EARLL MURMAN: Dell.

AUDIENCE: Walmart.

EARLL MURMAN: Walmart.

AUDIENCE: UPS.

AUDIENCE: Toyota.

EARLL MURMAN: UPS, Toyota, OK, exactly. OK, so here's our objectives for this module. At the end of this module, you'll be able to recognize the importance of suppliers in the enterprise. I think you probably know that, going into the module.

We're going to talk about the four key attributes of a lean supply chain. One of them is aligning the design, the product design, or whatever your area is with the supply chain. There needs to be an alignment there.

One is having the suppliers participate in your material flow. I saw someone for the supplier table coming up here, delivering parts. That's participation in this material flow; Having them actually involved in the design and development of your product; and then the information flow.

And so then, also, most organizations have a legacy supply chain that they have to transform. Aspect Medical was lucky. It was a startup. But we heard from Jeff, for example. The company's been in-- Jeff, 1889?

AUDIENCE: 1849.

EARLL MURMAN: 1849-- OK, they had a legacy supply chain they had to deal with. This picture diagrammatically shows how suppliers interact with both the product development and production. So remember, the customer is the one that specifies the value.

And then the role of product development, or engineering, which Annalisa is going to talk about this afternoon, is really to develop a design which, when produced, meets those customer expectations. OK? And one of the things that happens in a lean supply chain is to get those suppliers involved early, not think of them as something you add on at the end of your design, but to get them working with you during the design.

And in the aerospace area, typically, 60% to 80% of the product value, that is, the dollar value of the product, is outsourced to the suppliers. And now, we saw that yesterday at Aspect Medical. They didn't give us the numbers, I don't believe, but they don't make anything. They assemble things. OK?

John Coolidge said that they're a final assembler. So a lot of the value of that product, they buy from suppliers. So suppliers are absolutely critical to their success.

Then, when it gets to production-- and Annalisa is going to talk more about the interaction of product development and production, where the value is created and delivered back to the customers-- you want to have your suppliers as partners. So you have to think of the suppliers as part of your enterprise. And we call that the extended enterprise. So today, you want to think about those guys at the back table as part of your enterprise. They're not somebody you just send orders to and get parts from.

OK, now what does a supply chain look like? Well, here is a generic picture, starting with the end user, customer, the prime, all the way down to some raw material supplier. And usually, these are in tiers-- first tier, second tier, and third tier suppliers. And as you move down the supply chain, each tier represents a smaller proportion of the mean business. But they're very critical.

So let's just get a little example. We have an interesting group here, a very diverse group. So let me call on some people. And tell us a little bit about where you fit in in your supply chain and how far up and down you can see.

So Tam, you're with Intel. OK, where in Intel do you fit in this? Are you a prime, or are you a supplier to a prime?

AUDIENCE: I'm not really sure. I worked at [INAUDIBLE]. So I would say I [INAUDIBLE] the facility that's prior to and lean part of [INAUDIBLE].

EARLL MURMAN: OK, so a couple of things here-- first of all, Tam is in product development, and he doesn't know what his supply chain is. Right? OK? Is that what I hear? Who's your end customer? Do you know?

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: OK, so that's not the end customer. But you have a manufacturing-- that's your customer, is the manufacturing facility. And what are they making?

AUDIENCE: Powder products.

EARLL MURMAN: A product--

AUDIENCE: Or end products.

EARLL MURMAN: And are they then selling that to Hewlett-Packard, or somebody?

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: OK. And so they go to some customer from Intel. And then eventually, some end user, like Donna?

AUDIENCE: Lynn.

EARLL MURMAN: Sorry. Lynn-- she's using her computer. She's the end user.

AUDIENCE: Yes.

EARLL MURMAN: OK, so let's pick a different. Luis-- Luis, you're with the US Air Force.

AUDIENCE: Yes, sir.

EARLL MURMAN: OK. Now where are you in this supply chain here?

AUDIENCE: Well, we're a developer. So we would be a customer.

EARLL MURMAN: You'd be a customer. OK. And who might be the end user of what you develop?

AUDIENCE: The Space Wing, the 45th Space Wing.

EARLL MURMAN: Oh, the Space Wing.

AUDIENCE: The 45th Space Wing.

EARLL MURMAN: OK, Space Wing. OK. And sitting where you sit as a customer, how far down the supply chain do you interact with people?

AUDIENCE: Not very far down, because we have a contractor that does all that for us.

EARLL MURMAN: OK, so your contractor's is Lockheed or Northrop Grumman?

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: OK, so you interact with a contractor, who interacts with the suppliers. OK. Now Carlos, you're with Cargo?

AUDIENCE: Yes.

EARLL MURMAN: OK, and in Mexico, right?

AUDIENCE: Yes.

EARLL MURMAN: OK, so do you do food products?

AUDIENCE: Yes.

EARLL MURMAN: OK, so where would you be in this supply chain?

AUDIENCE: [INAUDIBLE] are on the prime manufacturers [INAUDIBLE].

EARLL MURMAN: OK, so you're the prime. And who might be your customers?

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: Huh?

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: OK. And then, how far down the supply chain do you [INAUDIBLE]?

AUDIENCE: We're the last, the last [INAUDIBLE].

EARLL MURMAN: You see all the way down the supply chain [INAUDIBLE].

AUDIENCE: [INAUDIBLE]

EARLL MURMAN: OK, I'd like to call one more group here. And I don't know much about it at all, someone from the Veteran's Administration. So Doug? Yeah, you're working with health care and stuff like that.

AUDIENCE: Yes, I'm basically at the end user.

EARLL MURMAN: OK.

AUDIENCE: I work in the lab department.

EARLL MURMAN: Oh, OK.

AUDIENCE: So I'm actually a customer. And I provide results to the physicians. And I interact with the [INAUDIBLE].

EARLL MURMAN: OK, cool. OK. So you can see that these are just different examples of supply chain. Now, one of the things that comes out a little bit in this little exercise we did, but is really a very true thing, is that most people in a non-lean supply chain don't have much visibility up or downstream in that supply chain. And so what they get is what we call-- they get the orders over the wall.

So you might give an order for reagents, and they don't even know it's going to come until, all of a sudden, it arrives, if it's a non-lean supply chain. So there's a lack of visibility. If you're in the supply chain, there's not much visibility upstream or downstream, what's happening, until all of a sudden, you get something, a request, and you have to react to it.

And that's kind of what you have at the back of the table there. You don't have much visibility of what's happening up here. And so that means you're in a very response mode. OK.

So now let's do a little exercise. Here are some attributes of supply chains. And what we want you to do is gather around your easel charts and discuss these a little bit. And write down, which of these attributes do you identify with what you might think as a lean supply chain, realizing we haven't really covered that topic yet? But this is part of how we're going to go about it. And talk a little bit about what you think might be the top three priorities for a lean supply chain.

So let's just say, for example, you picked all these as representing a lean supply chain and not those. Which of these are the three most important, do you think, to have a lean supply chain? So let's spend about 10 minutes doing that, around your easel charts. And then we're going to see what we collectively come up with, a lean supply chain. OK?

AUDIENCE: Should we invite our suppliers now?

EARLL MURMAN: Yeah, you can invite your suppliers if you'd like. Sure.

[LAUGHTER]

That sounds like a good practice. OK. So let's see. Let me call on the table up here, table in the northeast corner, northwest corner of the building. What are your top characteristics of a lean supply chain? And why did you pick them? Someone want to give us that briefing?

AUDIENCE: Well, [INAUDIBLE].

AUDIENCE: [INAUDIBLE]

AUDIENCE: The first one we picked was responsive and agile. We need our supplier to give us what we need, when we need, and in a timely manner, so that we can make those [INAUDIBLE] quota enterprise approach, so the end to end. So just knowing what the other processes means we don't end up with national [INAUDIBLE].

And then we had [INAUDIBLE] with collaboration and continuous [INAUDIBLE] activities with the supplier customers-- again, just partnering with our suppliers and not just [INAUDIBLE].

EARLL MURMAN: Good. OK. Good choices, good choice and good priorities. How about back here?

AUDIENCE: We did collaboration and supplier commitment with long-term relationship, which probably go together. Because if you're going to have a long-term relationship, you're going to work together.

EARLL MURMAN: Good rationale.

AUDIENCE: Visibility of demand, so you can see what's coming; and just continually improving.

EARLL MURMAN: Continuous improvement-- OK, good. And you had some others up there that you put a lower priority.

AUDIENCE: I mean, the enterprise approach made sense, of looking at the whole envelope. And build to order, so that your activities are driven by the customer requests and the responses.

EARLL MURMAN: OK, good. OK, let's take one more. And then how about up here with all the colored dots. It looks to me like you did the multi-voting. That's good.

[LAUGHTER]

Someone want to tell us about that?

AUDIENCE: Yeah, we [INAUDIBLE]. We say that this customer is just good. When we came to the queue that [INAUDIBLE] continuous grouping was [INAUDIBLE]. Together, it's collaboration and the holistic enterprise approach.

EARLL MURMAN: OK, so we're seeing some commonality here. Let's see, let me just look at the others. I see the same things on the remaining ones here. OK, so I think you guys got pretty much-- very good. You're already beginning to identify what a lean supply chain is, before you even have heard about it, so to speak, which is part of the purpose of this exercise.

Another thing we see is the priorities are a little bit different between tables. And this reflects what happens in the real world, is that different organizations might have different priorities as to what they think is most important in a particular time with their supply chain, for whatever reason you picked at your table. But maybe they're having difficulty with collaboration, or something, so collaboration is going to be more important right now in getting their supply chain lean than something else.

The only thing I would add-- that the build to order, I understand why you put it there as a response to the customer. But that's actually a way of describing a non-lean supply chain, where you ship orders, and they send you back materials. But you don't really engage them at all in the design of the product. You just send them an order, and they send it back-- kind of send me the blueprint and send me back the parts, and let's negotiate on price, type of thing.

So the ones that are identified here as a lean supply chain are collaboration-- you got that; responsive and agile-- you got that; based on product characteristics-- I don't think we had anybody come up on that, but we're going to talk about that in a minute; enterprise approach; a commitment to a long-term relationship; a visibility of demand, which was getting over that brick wall barrier; and the continuous improvement. So we're on the same page.

OK, so let's move on now to the second main learning objective. So you can now recognize the attributes of a lean supply chain-- I mean, the main attributes. Here are the four we're going to talk about. And the first one is alignment with the product characteristics.

And this may be a little bit theoretical, but you can think of it, in theory, of two ends of the extremes. One is you have a push system, where somebody builds parts and sends them to you. They build their parts, thinking about some demand that might be out there. And then they're ready to send them when somebody makes an order.

And the other extreme would be a pull supply chain, where they don't build anything until you ask them for that, in some way respond to the customer demand. And in some sense, supply chains are a combination of push and pull. These are theoretical concepts at the end of a spectrum.

But a push supply chain might be most prevalent in a commodity area, where you're maybe still in the economies of scale mentality. Let's build as many as we can and ship to the demand that comes. In a mature environment, that probably works pretty well. OK.

So paperclips-- we're going to use some paper clips tomorrow on one of the exercises. People making paper clips-- they kind of know about what the demand is going to be. It doesn't change that rapidly, so they can maybe do a push supply chain type thing. Where a pull supply chain, you have some specialized part, at the other extreme.

We're going to show you, in a little bit, an example from Lockheed Martin, where one ship set a year of tubes for an Atlas V rocket, they don't want to make those tubes until they know that the rocket's about ready to be re-sent. So the point is that your product may be made up of different components. And the supply chains that go with those may be managed somewhat differently. One size doesn't fit all. So that's what it means to align your product-- your supply chain with the product characteristics.

OK, supplier participation in material flow and logistics-- just-in-time deliveries-- I think everybody's pretty much familiar with that, that that's really an output of the Toyota production system and all. And of course, the crucial thing is that the parts have to show up when needed, because just-in-time parts go right to the assembly line. And so if they don't show up when needed, then everything else gets impacted.

On the other hand, the advantage is there's no inventory. And if there are any issues that come up on quality type things, you can correct them right away. OK, so just-in-time deliveries; kitting for point-of-use-- we talked about that a little bit yesterday. And let's put that off, because the next example shows that.

Vendor-managed inventory-- this is where the inventory, instead of being owned by the customer, is taken care of by the vendor. Let me give you an example of that. So JDAM is a Joint Direct Attack Munition. We have a picture of it coming up later. It's made in East St. Louis. And one of the parts for that is made in California. I think it's a tail cone, or something.

And when I went through this plant in East St. Louis, Missouri, there's a video camera on the ceiling in the loading dock, where they receive parts. So what's that video camera for? Well, the supplier in California is looking at what the inventory is there in East St. Louis and seeing when it's time for them to ship more. So they're managing the inventory of that product.

And third party logistics-- this is, instead of that organization shipping, or the receiving organization shipping, they delegate that to FedEx. And FedEx, they hire FedEx to handle all the shipping. And so UPS and FedEx and those big companies, like Atlas Air-- do you guys do that?

AUDIENCE: [INAUDIBLE] we have [INAUDIBLE].

EARLL MURMAN: Pull their elements, yeah. So there's a big business in these third-party logistics. So let's look at an example now. And think about these on this next example, and how many of them do we see?

OK, so this is the Atlas V. The Atlas V is a large launch vehicle. The Atlas V and the Delta IV are the largest launch vehicles. These are big rockets. OK? And they receive tubes, when they have to put together a rocket, and what they call a ship set. They call that a ship set. And a ship set of tubes cost $180,000.

And now, how do they come? Well, in the old way, they came as separate parts. A ship set has 199 parts in it. And they came all in their own packing boxes, separately, wrapped up in foam, and stuff. And you've got all this waste and lots of stuff coming in. That's the old way.

The new way is they come in this kit. And everything, all 199 parts, with these five major tubes-- they have the connectors and all-- come as a kit. And they not only come with the hardware, but the tools to assemble them. And usually, the instructions that go with it are right with that.

So there were some [INAUDIBLE] cards yesterday about kitting. And this is what kitting is about. OK? And now, they make about one or two of these rockets a year, or a small number. So they keep their suppliers informed when they're going to need that.

And all this is managed as one. So they don't ship these until-- this is a pull system. They don't ship it until they know that they're going to need it, because it's an expensive thing to have in inventory. And all this 199 parts is one record in their MRP system. instead of 199 different parts they're checking, following, they follow one-- so the great reduction in costs, handling costs, and carrying costs in cycle time. So some of those things we saw on the previous slide-- kitting, vendor-managed inventory, pull system, you see in situations like this.

OK, let's now turn to supplier involvement in design and development. And oh, by the way, this is a little bit of a segue slide, because this is this JDAM munition I mentioned before. And the JDAM part is it's a retrofitted tailcone on a otherwise dumb bomb. And it turns into a smart bomb. It has a receiver in it and GPS system, and so on.

And all of this, by the way, comes in a kit. Here's what it looks like. OK? So that's a kitting. But more importantly, here, when the JDAM was developed, it was done very uniquely. This is an Air Force procurement.

And when they formed the proposal team to bid on it, a competitor proposal team, they had McDonnell Douglas, at that time, and Lockheed bidding. That proposal team actually had the key suppliers on it. And it also had an Air Force representative on the proposal team. They were proposing to the Air Force, but there was an Air Force representative on it.

The Air Force representative was not on for business reasons. The Air Force representative was on so that the designers understood the requirements of the Air Force. So they understood the requirements.

They had what they call gold congruency. All the members of this team knew what they were trying to achieve. They were trying to achieve the winning bid that satisfied the Air Force customer needs. OK? That was what drove all their decisions. And so they understood what the costs, the requirements were.

Now, what did they do? They got the designers, and the subcontractors were involved in the design. And this turned out, that in the process, the subcontractors had to rearrange their expected work share. Some subcontractors gave up a portion and others gained.

So actually, if you think about it from a narrow point of view, you're giving up some business, so that you can gain some. But they knew that that was important to win the contract. And so they reallocated work share.

Specifically, they had some partitioned electronics on separate boards. And they realized, that if they integrated those on the same board, they could greatly reduce the costs, and so on. And the result was, where they originally thought this unit was going to cost $68,000 per unit, in the end, it cost $15,000 per unit.

And Boeing now-- McDonnell Douglas was bought by Boeing. Boeing is making these things. That's the plant in East St. Louis. And everybody's happy. Boeing is making lots of money. The Air Force is getting lots of supplies. But look how much cost reduction they had by getting those designers involved in the development, subcontractors involved in the development and design.

OK, then the fourth attribute is the seamless flow of information. And this is a busy picture, which we don't want to read all. But the point is that we got here the system integrator, the Aspect Medical. And we have over here the supplier.

And in a non-lean supply chain, what would happen is, over here, an engineering of the supplier, they may have a question. They would go up to their sales department. That would come over here to procurement. It would come down here to get answered-- lots of vertical communication paths.

What you want in a lean supply chain is a lot of horizontal communication paths. And you need to align it with the level of the organization. So you would like engineers talking with engineers.

Now, sometimes we give this talk at a government procurement audience. They say, oh, that's illegal. Can't do that. It may be, but that means it's also not lean. OK? Those things can be changed. OK?

But you have to have some clear guidelines about what's communicated, who has responsibility to communicate. But you want these people on the phone and on email contact, sharing information, to have a flexible, responsive supplier. OK, so we've got a lot of information flow.

Common databases-- you want to be accessing the same database. You want to have members on the same integrated product team. We'll talk about that tomorrow. You want to be exchanging technical data at this level, not going up and down, and some other things here, which we won't go into. But clearly, that's a different way of doing business from an environment where you have a non-lean supply chain.

OK, another example of smooth information flow is Exostar. Exostar is a company, an organization, which manages the interactions between major aerospace companies and their suppliers. So it's like a hub in the supply chain. They have 34,000 participants in this system. And it's all electronic.

So suppose Boeing wants to buy some kind of, say, actuators. Instead of going to all the actuator companies, they go through Exostar, who manages that transaction. And it's all very paperless. And it's just been a huge savings.

And here are some results from Rolls Royce, which is one of the members, some of the metrics that go with their participation in Exostar. Instead of having several thousand suppliers, they deal with several hundred; reduction of cost of goods purchased of up to 20%, because of this integrated supplier management; system inventory levels down 80%; error reduction down, because they're not manually entering in a lot of data; reduced cycle times as much as 80%; basically, elimination of paper; and improved relations, who have benefited from this reduced transaction costs.

OK, so now let's move to the last topic of the module. And that is, how do you improve the existing supply chains? Well, we already heard from Jeff yesterday. You work with your suppliers. OK? You look at your value stream. You try to find out, who are your critical suppliers? You want to work with them.

So who's on the critical paths? Where are the high-cost items or the long-lead items, and so on? And Jeff just couldn't have said it better. Yesterday, he said, when they started their lean transformation, they went out and let their suppliers know that they weren't dropping them. They were just going to deal with them differently. OK?

If the supplier is ready to become a lean organization-- now, they may not be ready yet. They may not have the right management, or they may not be educated. They might not have taken a Lean Academy and learned the importance of this. Then they've got to do some prep work.

But if they're lean-ready, then they can go out. And the prime will actually work with the supplier. They'll go out, and they'll run Kaizen events with them. They might lend them a lean expert to be on site for a while. They might invite them to their training programs.

We taught one of these Lean Academies at Raytheon, up the road-- not Raytheon-- Textron Systems, up the road, here in Wilmington, Delaware. A couple of years ago, Hugh and I and Jackie taught that.

And they invited their suppliers to the class. They had about five suppliers, some from California, some from Colorado. They build their relationship. They understand what the value-stream mapping, that value stream is. They come up with their plans to develop a lean strategy in that organization. And they have some mutual workshops and Kaizen events and a kind of a continuous improvement cycle.

So this is the way a lean organization works with its suppliers. It helps them. It invests in them. Actually, we have some people here from the Veterans Administration. Rockwell Collins, which we've already talked about in this Lean Academy, starting to see that some of their major costs were their health care for their employees in the Cedar Rapids area.

So they started working with the Cedar Rapids hospitals to help them become lean. Because they knew, in the long term, it was going to benefit them. And they loan their lean experts to Mercy Hospital in Cedar Rapids. And they're doing gratings now.

OK, here's one example from Boeing about Hicksville Machine Works on Long Island and some of the benefits that came out. And these benefits that Hicksville came from Boeing, they're going to use with other customers. Boeing invested in it, and they'll use other customers. That's OK, because everybody's going to win. So those are typical type things.

Now, as you do this, you start treating your supply base more strategically. Instead of a supply base being all the same, you're strategic. So certain ones you have strategic alliances with, these might be really critical partners. For instance, Rockwell Collins has a strategic alliance with Boeing, because they build flight decks.

Your suppliers-- you'll certify them, so that-- say a gold supplier is very reliable. You might not do any inspection on something that comes in from a gold supplier. It just goes directly online, because you know that they have their processes under control, and that they've inspected it before it left, and taken the quality responsibility.

Where, someone who is on probation might be just the opposite. You're not having good performance from them, so you have a lot of quality control. Then you might have your people out in their-- they might be having troubles with their production system. And so you're sending help out there to help them.

OK, strategically support-- important suppliers might have, say, some particular kind of materials, some titanium, or something, that maybe there's only one supply for. So that one, you want to treat strategically. These are the commodity items-- a core. And then these are the ones you get rid of. They're just not performing. So supply chain management is a core competency of a lean organization.

OK, where are we going in the future? The old approach is the build-to-order. The customer sends an order to the prime. The prime sends it back to the customer. The prime puts it down to the subcontractor or the subcontract-- so a lot of interfaces, rigid interfaces, lack of communication, distrustful relationships. The prime beats up on their supplier-- get your costs down, that type of thing.

Current lean is much more collaborative with sharing a lot of information. So you might invite your suppliers in and give them your sales forecasts, your business plans. That's very proprietary information for most companies. But if it's an important supplier, you want them to know what the visibility is.

Emerging lean is like with the JDAM, where you actually form almost like a company for that project. And you open up your proprietary databases for design and development. And there's some examples in our book about that.

OK, so wrap up-- suppliers are critical to the lean enterprise success. Supply chains need to be understood and designed to meet the needs of the product. Legacy supply chains can be improved through win-win customer supplier teamwork. And it's a core competency of a lean organization.