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00:00:01,430 --> 00:00:07,340

\h Announcer: Please welcome Bob Hartline, chief sustaining engineer for Universal Orlando.

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00:00:07,340 --> 00:00:09,690

\h Bob Hartline: Hi, good afternoon, everybody. Thanks for inviting me.

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00:00:09,690 --> 00:00:16,780

\h It's my pleasure to be here. My name is Bob Hartline, I'm the chief sustaining controls engineer,

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00:00:16,780 --> 00:00:21,660

\h I'm a technical guy. I talk about control systems and how we make things move,

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00:00:21,660 --> 00:00:28,700

\h and lights flash and sound come out of things, and that's what I think in the parks.

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00:00:28,700 --> 00:00:35,020

\h What I'm going to talk about today, how this works, oh, they left it, fancy.

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00:00:35,020 --> 00:00:42,280

\h Innovation through partnerships, in other words, how to succeed in innovation partnering with outside

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00:00:42,280 --> 00:00:45,450

\h vendors or commercial off the shelf products.

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00:00:45,450 --> 00:00:52,690

\h I have learned being here today that, you know, if we were talking about spacecraft, apparently commer

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00:00:52,690 --> 00:00:58,650

\h off the shelf spacecraft are available so I guess I'm done.

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00:00:58,650 --> 00:01:05,170

\h Let's buy one! Anyway, we're going to talk about a few things, the first part is why is this a good idea,

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00:01:05,170 --> 00:01:12,920

\h and I know that C.O.T.S., commercial off the shelf has been the topic for many years and

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00:01:12,920 --> 00:01:18,800

\h everybody has the general reasons why they do that and pretty well still hold today.

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00:01:18,800 --> 00:01:26,270

\h You have reduced development cost because you don't have to recreate the wheel.

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00:01:26,270 --> 00:01:30,470

\h The diversity and third party certification as well, we're talking about there is a lot of different

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00:01:30,470 --> 00:01:36,990

\h products out there, and now technology has advanced in very recent years to where now we can buy sy

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00:01:36,990 --> 00:01:42,200

\h where somebody else is doing a lot of legwork for us, more than normal, to the point that we're getting a

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00:01:42,200 --> 00:01:47,970

\h third party like a TUV or somebody line that to tell us that this component is safety rated.

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00:01:47,970 --> 00:01:53,960

\h So when you're building safety rated systems and we all were in that business, we can take a lot of that

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00:01:53,960 --> 00:01:57,850

\h workload off of ourselves, because somebody else is now doing that.

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00:01:57,850 --> 00:02:06,180

\h That's important to me, because in my business, we run theme parks, we do attractions.

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00:02:06,180 --> 00:02:13,850

\h It's a little different, our systems, most of our systems are life safety rated, a little difference between

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00:02:13,850 --> 00:02:19,230

\h us and maybe you guys is you have trained people on your machine, and you've got training people ope

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00:02:19,230 --> 00:02:24,290

\h in the console, and you put them on the machine and they go somewhere.

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00:02:24,290 --> 00:02:32,260

\h We get Ma and Pa smith from Kansas that have saved up for bringing their family for that once in a

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00:02:32,260 --> 00:02:37,620

\h generation trip to a theme park for the experience and they get on the ride and at best, I hope they really

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00:02:37,620 --> 00:02:42,080

\h read the sign that said keep their hands, arms and legs in the vehicle at all times and that they remember

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00:02:42,080 --> 00:02:45,150

\h that when they get on because they don't know anything else.

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00:02:45,150 --> 00:02:52,350

\h They don't know what to expect, so we have to put them on this machine and you know, we can't rely on

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00:02:52,350 --> 00:02:57,690

\h to help us operate the machine, so one of our things we had to deal with is what can they do for us or to

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00:02:57,690 --> 00:03:00,880

\h mess up our machine, what can our machine do to mess up them and we

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00:03:00,880 --> 00:03:05,320

\h have to do functional safety testing for everything.

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00:03:05,320 --> 00:03:08,200

\h We have trained operators at your launch control system.

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00:03:08,200 --> 00:03:12,040

\h I have high school kids. And they're trained.

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00:03:12,040 --> 00:03:14,580

\h They know what to do and they know what's going on,

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00:03:14,580 --> 00:03:19,060

\h but it just puts more of a reliance on the system to do the work.

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00:03:19,060 --> 00:03:28,210

\h So the way we operate our systems basically is, I'll pop these up here and run down them a little faster.

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00:03:28,210 --> 00:03:34,020

\h The way we do our systems is we have to buy off the shelf equipment just like we used to say nobody b

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00:03:34,020 --> 00:03:40,450

\h rocket but I guess apparently again, people are, but when we do theme parks, the mechanism that we p

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00:03:40,450 --> 00:03:45,610

\h on to move you as a machine that generally exists somewhere else in the world, somewhere else in ind

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00:03:45,610 --> 00:03:50,630

\h and what we do is we take two or three or four different pieces of that machine or two or three or four or

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00:03:50,630 --> 00:03:56,460

\h five pieces of that different machine, stick them together and we make a new machine, and then we stic

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00:03:56,460 --> 00:04:02,280

\h on the end of it, and then we send you around and we do this where we have to do it sometimes we do

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00:04:02,280 --> 00:04:06,330

\h often as every 15 seconds, we cycle equipment so we've got equipment

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00:04:06,330 --> 00:04:10,600

\h that will cycle in some cases a million times a year.

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00:04:10,600 --> 00:04:18,510

\h But when we go to do that, we buy this stuff from other people because we don't have the, really the fun

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00:04:18,510 --> 00:04:22,520

\h and stuff to invent this stuff from scratch nor do we normally have a time frame.

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00:04:22,520 --> 00:04:28,680

\h Usually we're in a rush, somebody comes with an idea to build an attraction based on intellectual proper

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00:04:28,680 --> 00:04:35,420

\h right we take off and run and get it done and that's definitely about a three-year turnaround from concep

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00:04:35,420 --> 00:04:41,930

\h to the day we get it open, but we have to go buy these parts from manufacturers.

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00:04:41,930 --> 00:04:50,440

\h When we do that, we go long and hard and deep into the guts of their company to find out how they work

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00:04:50,440 --> 00:04:57,060

\h what they do, and what we learn with things like this is manufacturers have better availability to parts, so

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00:04:57,060 --> 00:05:01,840

\h when you have, you don't think about that normally but when you have something like a tsunami hit japan

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00:05:01,840 --> 00:05:08,450

\h the only manufacturing facility, now you're down to one that makes a thin film capacitor or something like

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00:05:08,450 --> 00:05:13,740

\h that, well the guy that's buying, you know, 4 million of them a year is going to beat the pants off of you

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00:05:13,740 --> 00:05:16,770

\h when he goes over and places his order compared to you wanting a couple

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00:05:16,770 --> 00:05:20,940

\h dozen for something or whatever the component may be, so they have that.

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00:05:20,940 --> 00:05:25,450

\h Inventory and training and maintenance, when you go off the shelf with industrial products that are out

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00:05:25,450 --> 00:05:31,260

\h there today, inventory for standard products is held by distributors as well as you can do assignment, you

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00:05:31,260 --> 00:05:37,290

\h have factory stock so you're not custom building a bunch of these things and putting them on your shelf

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00:05:37,290 --> 00:05:43,820

\h dealing with that cost, and as far as the training goes, and maintenance cost, same way you have factory

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00:05:43,820 --> 00:05:49,560

\h training available on the items and that we've learned over the time is as things have gotten better and

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00:05:49,560 --> 00:05:54,040

\h technology is improved, things are now we can take more things off the

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00:05:54,040 --> 00:05:57,640

\h shelf and do more things with them because things have more connectivity.

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00:05:57,640 --> 00:06:05,170

\h I can take this box and talk to that box and talk to this sensor, exchange an awful lot of data, and I can

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00:06:05,170 --> 00:06:10,670

\h get all the information I ever wanted to know, and more, and I didn't have to invent a thing, so from the

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00:06:10,670 --> 00:06:16,560

\h process of the one box that takes off and does the operation over here, all the way over to the display

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00:06:16,560 --> 00:06:18,830

\h screen over here that gives me, that's all off the shelf now.

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00:06:18,830 --> 00:06:25,620

\h People are doing this in other industries, not just we do, but pharmaceutical industries,

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00:06:25,620 --> 00:06:28,730

\h petrochemical, all that stuff they need all that same information.

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00:06:28,730 --> 00:06:32,330

\h Manufacturing is now wanting to trace all the raw products,

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00:06:32,330 --> 00:06:37,530

\h I want you to produce in an hour what their yields are, they want all that same information.

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00:06:37,530 --> 00:06:42,200

\h The information is there now, it's free and available and you can get to it and use it.

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00:06:42,200 --> 00:06:46,590

\h We have smart devices now which plug and play.

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00:06:46,590 --> 00:06:52,710

\h We just run one cable to something and we get up online, it tells us what it is and we can control it.

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00:06:52,710 --> 00:06:59,300

\h Another thing for security, that's become a big issue, if anybody knows the word stucksnet from a couple

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00:06:59,300 --> 00:07:07,230

\h years ago for industrial control systems and automation systems, it was malware that has got into the

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00:07:07,230 --> 00:07:12,650

\h control system, designed for one control system, we won't talk about what it was for but it was actually a

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00:07:12,650 --> 00:07:18,560

\h cool thing, you missed it, which is all good but it brought to the attention of the hacker community, which

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00:07:18,560 --> 00:07:22,710

\h after now for the last couple years is spending a lot of time researching that.

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00:07:22,710 --> 00:07:29,530

\h We have learned that the hacker community is pretty diverse, but that's been brought to the attention th

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00:07:29,530 --> 00:07:37,110

\h these machines that control things, that make things happen, make things move, do not normally have a

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00:07:37,110 --> 00:07:40,430

\h of protection on them or really don't have a methodology protection because

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00:07:40,430 --> 00:07:45,960

\h they were designed to turn things off and on and control machinery.

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00:07:45,960 --> 00:07:52,160

\h So hackers have now decided that this is a fun thing to do, it's a fun thing to take over a water treatment

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00:07:52,160 --> 00:07:57,360

\h it's a fun thing to take over the power grid, it's a fun thing to take over control of a roller coaster,

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00:07:57,360 --> 00:08:03,300

\h it's a fun thing now to go down the street and change the readings on your power meter, because you h

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00:08:03,300 --> 00:08:09,480

\h wireless power meter on your house and get an electric bill for \$15,000 because somebody thought that

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00:08:09,480 --> 00:08:14,550

\h These guys are hacking and doing everything, so we've learned that with the commercial off the shelf

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00:08:14,550 --> 00:08:18,950

\h equipment because of the common protocols we can use that technology to protect

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00:08:18,950 --> 00:08:25,190

\h itself a lot simpler than you could do if you have some proprietary protocols.

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00:08:25,190 --> 00:08:30,980

\h We've actually done a system throughout the system that we're starting up now that I can say I had a pa

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00:08:30,980 --> 00:08:37,480

\h that we actually have a patent going forth with my name on it that detects changes into security systems

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00:08:37,480 --> 00:08:41,160

\h into the security of any kind of automated control system.

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00:08:41,160 --> 00:08:47,490

\h So we're getting there, and making great head ways, things changed dramatically in the last three to five

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00:08:47,490 --> 00:08:53,370

\h years as far as the technology and what you can do with what you can buy off the shelf.

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00:08:53,370 --> 00:08:57,160

\h Another thing is technology life cycle, you know, I'm sure you guys fight the

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00:08:57,160 --> 00:09:00,270

\h same battles with obsolescence that we do.

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00:09:00,270 --> 00:09:06,380

\h Over the years we used to say things were good for 10 to 15, maybe 20 years on the outside.

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00:09:06,380 --> 00:09:14,060

\h Life cycle now in technology from manufacturers is basically three to six years and in the next ten years

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00:09:14,060 --> 00:09:19,730

\h they expect it to three years is about all you'll get out of something, all to expect they'll support it.

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00:09:19,730 --> 00:09:26,830

\h Microsoft obviously and windows operating systems, you know, they always, the new answer is just go l

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00:09:26,830 --> 00:09:33,000

\h new one, but sometimes if you got windows 2000 machine and want to put windows 8

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00:09:33,000 --> 00:09:35,850

\h on it you have to buy the computer to go with it.

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00:09:35,850 --> 00:09:38,870

\h They don't care about that. They'll tell you to buy a new one.

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00:09:38,870 --> 00:09:46,300

\h Technology life cycles are changing quickly and again with newer technologies, manufacturers are start

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00:09:46,300 --> 00:09:51,980

\h move forward with backwards and forwards compatibility so you don't have to do this complete hardwar

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00:09:51,980 --> 00:09:59,410

\h replacement so you can stay in one platform and migrate without starting all over again.

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00:09:59,410 --> 00:10:08,380

\h Again, we'll just go with what I just said, same thing. I'm not going to repeat myself. So where to start.

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00:10:08,380 --> 00:10:13,790

\h You have to determine your functionality requirements, obviously what you're going to build, whether it's

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00:10:13,790 --> 00:10:19,000

\h safety and reliability or always number one in my industry and I'm sure the same thing for you, we have

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00:10:19,000 --> 00:10:23,230

\h we run Central Florida theme parks last year according to the

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00:10:23,230 --> 00:10:25,270

\h internet because we don't release official numbers.

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00:10:25,270 --> 00:10:34,480

\h It says we moved about 60 million people through Orlando theme parks last year, and that's an awful lot

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00:10:34,480 --> 00:10:40,940

\h people coming to ride rides and attractions and take that once in a lifetime experience and they all want

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00:10:40,940 --> 00:10:47,390

\h the different experience where they're over at Disney or seeing us or at SeaWorld.

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00:10:47,390 --> 00:10:53,670

\h So the safety requirements that you're going to set forth operational requirements, maintainability,

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00:10:53,670 --> 00:10:56,500

\h you have to know what your baseline is for that.

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00:10:56,500 --> 00:11:01,170

\h The requirements for functional safety and certification are not going to change whether you do it yourself

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00:11:01,170 --> 00:11:06,280

\h or whether you're going to go off the shelf or partially off the shelf and to go examine similar

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00:11:06,280 --> 00:11:11,710

\h applications and like industries, whatever your process may be, there's a very good opportunity, some p

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00:11:11,710 --> 00:11:14,780

\h of it is done in a similar fashion somewhere else,

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00:11:14,780 --> 00:11:18,390

\h whether it be petrochemical or pharmaceutical or even the theme park industries.

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00:11:18,390 --> 00:11:23,890

\h Jeff from Disney and I were commenting and touring some of the back areas here that

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00:11:23,890 --> 00:11:27,570

\h the back areas here look an awful lot like our back areas.

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00:11:27,570 --> 00:11:34,190

\h Lot of similar equipment, a lot of types of things, we do in some cases we do a controlled explosions,

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00:11:34,190 --> 00:11:43,120

\h by dumping natural IRP gas inside of buildings, do it every 30 seconds, we dump liquid nitrogen, we dump

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00:11:43,120 --> 00:11:50,370

\h we dump large volumes of water and monitor oxygen content in the buildings to make sure people still o

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00:11:50,370 --> 00:11:54,440

\h the other side, we have to do biodynamic testing and monitoring all the time.

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00:11:54,440 --> 00:11:58,070

\h Our systems are much more powerful than you expect.

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00:11:58,070 --> 00:12:04,550

\h I mean, we typically run them, we don't run them at full blast so they have the capability of, you know,

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00:12:04,550 --> 00:12:09,860

\h moving some body organs around if we shake you around too much so we have to make sure we do the

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00:12:09,860 --> 00:12:16,800

\h right every time so a lot of similarities, but we do this all with off the shelf products.

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00:12:16,800 --> 00:12:19,560

\h So there's a fair amount of similarities.

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00:12:19,560 --> 00:12:26,220

\h I will say this, and this I cannot stress enough, success in getting this done is purely in the details.

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00:12:26,220 --> 00:12:33,800

\h It's all about dotting the Is and crossing the Ts, and taking the time to do it right.

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00:12:33,800 --> 00:12:38,690

\h When you start dealing with outside manufacturers, will you find out they are all not created equal.

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00:12:38,690 --> 00:12:46,220

\h I'll say that when we deal with technology, and vendors that sell us technology, I classify them as, in two

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00:12:46,220 --> 00:12:50,920

\h different categories, there are manufacturers that make a technical product,

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00:12:50,920 --> 00:12:53,620

\h and they are out to strive to make the best technical product.

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00:12:53,620 --> 00:12:59,330

\h There are manufacturers that are out there to strictly go for price point and volume.

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00:12:59,330 --> 00:13:01,500

\h How many of these can I make? Okay.

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00:13:01,500 --> 00:13:06,110

\h And that being said, not all parts are created equal, not all sales engineers

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00:13:06,110 --> 00:13:09,520

\h and support people and designers are the same as well.

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00:13:09,520 --> 00:13:16,980

\h When we deal with sales engineers I find in my 30 years of doing this that I deal with the same small gro

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00:13:16,980 --> 00:13:23,160

\h It doesn't change a whole lot, so anybody outside that group that really just wants to sell me something

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00:13:23,160 --> 00:13:30,560

\h they can say they sold something to me or NASA, it's a mark on their card or report to the main office,

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00:13:30,560 --> 00:13:32,620

\h I call those guys peddlers.

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00:13:32,620 --> 00:13:37,970

\h So either a sales engineer and you have as much interest in making this project successful as I do,

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00:13:37,970 --> 00:13:39,890

\h or we don't deal with you.

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00:13:39,890 --> 00:13:42,840

\h You're not going to do this on price point.

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00:13:42,840 --> 00:13:46,510

\h It's not going to be the cheapest part, again people market stuff to see how

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00:13:46,510 --> 00:13:49,020

\h many they can sell for how cheap they can sell.

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00:13:49,020 --> 00:13:54,590

\h When you compare components like an electrical component, you look at the specifications and the det

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00:13:54,590 --> 00:14:01,620

\h one guy's got 30 volt isolation, the next guy is \$10 more but got 600 volt isolation.

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00:14:01,620 --> 00:14:05,660

\h So all to the details of getting it right.

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00:14:05,660 --> 00:14:09,470

\h Rarely will you ever be successful with one manufacturer across the entire product line,

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00:14:09,470 --> 00:14:11,270

\h despite what they tell you.

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00:14:11,270 --> 00:14:14,800

\h You will get a manufacturer and they'll tell you they sell you everything from

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00:14:14,800 --> 00:14:17,220

\h one end to the other and it's the best made ever.

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00:14:17,220 --> 00:14:19,240

\h They all do some things better than others.

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00:14:19,240 --> 00:14:24,810

\h Some guys are better at one product, another guy is better at another product and you will figure out ho

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00:14:24,810 --> 00:14:27,830

\h match them up, despite the fact they tell you they won't work together.

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00:14:27,830 --> 00:14:32,600

\h Lot of things we come up and do, we come up and do it at the manufacturer; you're going to do what with

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00:14:32,600 --> 00:14:35,050

\h It's never been done before or they tell you, you can't do that?

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00:14:35,050 --> 00:14:38,970

\h We say why can't we do that? They say it has never been done.

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00:14:38,970 --> 00:14:48,270

\h When you deal with these guys and we set up a mutual nondisclosure agreements so we can share our

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00:14:48,270 --> 00:14:52,180

\h they can share their deep secrets, we want to know what's coming out next year.

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00:14:52,180 --> 00:15:00,090

\h We can influence a product, if you made this one little change which in the product development stage r

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00:15:00,090 --> 00:15:06,300

\h absolutely nothing to them, you make this one little change we could do this, and when we do this,

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00:15:06,300 --> 00:15:08,420

\h now it's great, and I'm one up on the guy down the street.

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00:15:08,420 --> 00:15:12,300

\h We have friendly competition with the guys down the street but we always one up each other.

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00:15:12,300 --> 00:15:17,630

\h I have my secret projects, he's got his secret projects, so anyway, do that, audit processes and

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00:15:17,630 --> 00:15:22,280

\h certifications of manufacturers to make sure that they're doing what they're telling you they're going to

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00:15:22,280 --> 00:15:26,060

\h do, because not everybody is straight up on that either.

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00:15:26,060 --> 00:15:31,440

\h I always tell you, it's listen to the words they use when they tell you, because it's the words they don't

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00:15:31,440 --> 00:15:35,560

\h say is what they're not telling you the rest of the story, when they leave something out of a sentence.

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00:15:35,560 --> 00:15:42,020

\h When they ask a question and you don't get a direct answer it's always a true tale sign of what they're u

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00:15:42,020 --> 00:15:48,460

\h I'm not a trusting guy for inventors. I beat them all to death.