UNITED STATES

NUCLEAR REGULATORY COMMISSION

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BRIEFING ON DIGITAL INSTRUMENTATION AND CONTROL

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THURSDAY,

OCTOBER 25, 2018

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ROCKVILLE, MARYLAND

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The Commission met in the Commissioners' Hearing Room at the Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike, at 9:00 a.m., Kristine L. Svinicki, Chairman, presiding.

COMMISSION MEMBERS:

KRISTINE L. SVINICKI, Chairman

JEFF BARAN, Commissioner

STEPHEN G. BURNS, Commissioner

ANNIE CAPUTO, Commissioner

DAVID A. WRIGHT, Commissioner

ALSO PRESENT:

ANNETTE VIETTI-COOK, Secretary of the Commission

MARIAN L. ZOBLER, General Counsel

NRC STAFF:

ROSSNYEV ALVARADO, Digital I&C Engineer, NRR

ERIC BENNER, Director, Division of Engineering, NRR

MARGARET DOANE, Executive Director for Operations

HO NIEH, Director, Office of Nuclear Reactor (NRR)

      Regulation

DINESH TANEJA, Senior Electronics Engineer, NRO

MICHAEL WATERS, Chief, Instrumentation and Control

      Branch, NRR

ALSO PRESENT:

FRANK NOVAK, Senior Systems Engineer, GE Hitachi

      Nuclear Energy, Instrumentation and Control

      Group; Chair, IEEE Nuclear Power Engineering

      Committee Working Group 6.3

BILL PITESA, Chief Nuclear Officer, Nuclear Energy

      Institute

GEORGE ROMANSKI, Chief Scientific and Technical

      Advisor for Aircraft Computer Software,

      Federal Aviation Administration

CLAYTON SCOTT, Senior Vice President - Deputy,

      Global I&C Business, Framatome Inc.

DR. JOHN P. THOMAS, Professor, Massachusetts

      Institute of Technology

1   P R O C E E D I N G S

2   (9:02 a.m.)

3   CHAIRMAN SVINICKI: Good morning, everyone.   I call

4   the Commission's meeting to order.

5   We convene this morning in a public session to discuss the

6   progress of the NRC in implementing the regulatory infrastructure for digital

7   instrumentation and control systems and also to hear from a panel of

8   external stakeholders regarding initiatives in implementing digital I&C in

9   various capacities across the U.S. nuclear enterprise and in other

10   applications.   So I welcome all of our panelists here this morning.

11   I would note, given my long service on the Commission,

12   that I've participated in a number of meetings on the agency's progress on

13   digital instrumentation and control.

14   I would characterize that over the course of time there has

15   been frustration, I think, on the part of everyone including the NRC staff

16   themselves.

17   I don't want to use the term defeated but at times I think

18   the complexity of the issue has caused NRC to get, you know, a little bit

19   overwhelmed by it.

20   But we have - as a commission we have intervened

21   intermittently with direction things we thought would be helpful direction to

22   the agency as it approaches the issue so that we could break through some

23   of the things that were bogging us down.

24   I think today we will hear from the staff panel about their

25   hard work on the direction that we issued a couple of years ago and I think

26   we will hear from external stakeholders that it's a mixed review.

1   I think we will get some praise for things that we have been

2   doing recently but that a lot of hard work remains as well.

3   So I think this is an important meeting and I know that the

4   agency, the Commission, and external stakeholders all share a view that we

5   can continue to move forward and make progress on this issue.

6   The pace hasn't always been what I as an individual

7   member of the Commission would have liked to have seen.

8   But this meeting is important and I think the Commission

9   will hear these views and then assess whether or not there is any additional

10   direction that we could provide that would be helpful, maybe any

11   prioritization we could give to the agency's consideration of any open issues.

12   So I will certainly be listening in that capacity to see if there

13   is any helpful intervention the Commission can make here or any that is

14   necessary today.

15   Before we hear from our external panel, would any other

16   member of the Commission like to make any opening comments?

17   Okay.   Hearing none, we will begin with a panel of invited

18   external views. We will begin with Mr. Bill Pitesa, who is the chief nuclear

19   officer of the Nuclear Energy Institute, I believe just for a little while now

20   because his successor has been named and he will be returning to Duke.

21   He's been here as a loaned executive to NEI.

22   I want to thank you, Bill, for the engagement you've had

23   with NRC on any number of issues and I wish you well as you go home to

24   colleagues and family and also I look forward to working with your

25   successor.

26   MR. PITESA: Thank you.

1   CHAIRMAN SVINICKI: And please begin.

2   MR. PITESA: Thank you.   I assume we are going to start

3   the slides.

4   CHAIRMAN SVINICKI: And if you just - as you need them

5   to switch slides if you'd just say next slide or something they will take care of

6   it in the booth.

7   Thank you.

8   MR. PITESA: Perfect.   Thank you.

9   So we will go ahead to the next slide, please.

10   So, ultimately, digital I&C has been paramount to the

11   future of the nuclear industry and the Transformation SECY actually did a

12   very good job of characterizing the challenges we have seen within the

13   industry.

14   The current processes are just too cumbersome to

15   incentivize or even allow digital implementation.   A compliance-based

16   approach at a component level which the Transformation SECY talked about

17   precludes recognizing the broader benefits of digital controls to overall plant

18   performance.

19   Simply put, digital is strangling from an absolute certainty

20   or there may be a ghost in the machine mentality versus reasonable

21   assurance.

22   Personally having lived through the decade-long process

23   of approval and installation of a reactor protection system at Oconee, I've

24   really got firsthand experience on the challenges we have seen.

25   Next slide, please.

26   But all evidence still points to digital implementation

improving performance and safety, as you can see from these slides. The data shows that when we have analog systems versus digital systems, the digital systems far outperform the analog systems.

Plant transients reduce significantly following implementation of digital controls. Where we have mostly implemented digital controls on the nonsafety-related side, we have seen much better performance by the systems.

The systems are self-diagnostic and constantly monitoring signal inputs and feedback loops to ensure that any questionable inputs are disregarded and/or alarmed.

The Oconee reactor protection system is working magnificently. It was a great installation and this has to be our future when we think of all the things going on in our industry.

Next slide, please.

In this year we have seen progress. As you can see, the digital RIS 2002-22 has eased the uncertainty with a 50.59 common cause failure analysis for low safety significant systems.

So we are very appreciative that this was issued and it's an important step. The ISG-06, an endorsement of NEI 96-07 Appendix D is imminent. We believe it's going to happen this year.

We are looking forward to that, and we are working with EPRI to move additional guidance forward so that third party or commercial grade certifications can move the ball further on common cause failure concerns that we have across the board.

Next slide.

So ongoing industry workshops and NRC participation are

1   using case studies now to clarify available opportunities utilizing the RIS.

2   We have had training going on at Exelon, at Duke, at other

3   utilities and ultimately it's been very beneficial, and there has been very

4   positive feedback that the NRC has participated - staff has participated in

5   these - not training sessions but workshops.

6   And these workshops have helped open everybody's eyes

7   to the possibilities with digital that probably aren't being utilized currently.

8   We plan to use the same format when NEI 96-07 is

9   endorsed and we anticipate that we will see the same positive outcome that

10   we have seen before.

11   Next slide.

12   And, of course, this movement is very important right now.

13   On the slide you can see that there are a large number of areas where the

14   appetite for digital is still out there, and particularly on low safety significant

15   systems like control room instrumentation, recorders, chillers - circuit

16   breakers are a big one for the industry, digital controls, things - I mean,

17   diesel controls, there is an appetite for these low safety significant systems.

18   But as the bottom bullets show, there is also, we believe,

19   going to be a growing appetite for large digital systems that's really been

20   suppressed for the last five years or so and we think that's going to really be

21   tied to subsequent license renewal with the SLR applications coming in now

22   and we expect almost half of our industry will ultimately submit for a second

23   license, and we think that those companies will make decisions around

24   digital that previously had been considered probably financially challenging.

25   Next slide.

26   So you can see here that the total number of folks that we

1   have done some informal surveys within the industry on who is planning on

2   movement with the subsequent license renewal, second license renewal,

3   and you can see it's over half of the existing fleet that we anticipate to apply

4   ultimately.

5   We were very pleased to see the most recent application

6   being the third application from the industry and we anticipate there will be

7   many more to come.

8   Next slide, please.

9   Of course, whenever you talk about digital concerns can

10   be raised about cyber security - what is the cyber vulnerability associated

11   with digital.

12   And, fundamentally, we maintain one of the most robust

13   and inspected cyber security platforms used with any technology on this

14   planet.

15   I mean, we have a very robust system.   It's a proven

16   approach of isolation and lots of other controls that we have in place.

17   But overall, we have to stay diligent to make sure that we

18   maintain what I call an unassailable cyber defense with the upgrades in

19   digital that we will be making.

20   Next slide, please.

21   Going forward, we are very pleased with the RIS and the

22   proposed interim guidance.   But digital really is not across the finish line.

23   Ultimately, there are some things that we still need to do.

24   We need to risk inform common cause failures.   I think that's very important

25   and absolutely a necessity.

26   We need to recognize international standards and EPRI

1   studies. We need to incorporate accepted design guides, allow mitigation

2   of effects, and get more approval on the front end of an application than on

3   the back end of an application.

4   There is too much risk for almost any utility to take if the

5   approvals don't come until the installation is fully installed.

6   Next slide.

7   And it's not just technical. I would tell you that digital also

8   has some cultural baggage within our industry. Ultimately, there was a

9   SECY that was issued last month, and I believe Marge is going to speak

10   more to that later in the discussion on digital.

11   But when that SECY was issued, I think the intentions

12   were appropriate. But ultimately, when it referred back and said essentially

13   that the SECY from '93 was adequate and addressed CCF and things, the

14   industry read it and said, hey, you're saying the world of 25 years ago is a

15   perfectly good world now, and we don't believe that is true.

16   I don't think that was the intent. But it does create or it

17   does manifest that there is some misunderstanding still going on between

18   staff and the industry and we need to develop a relationship such that there

19   is a level of trust that we have a very common goal, going forward.

20   I hope we can bring a very fresh perspective and just leave

21   the past challenges where they belong, in the past.

22   Next slide.

23   So   when   you   look   at   the   transformation,   the

24   recommendations that Dan Dorman's team put together, I think they are very

25   strong.

26   We absolutely think that we need to implement those

1   recommendations. We need to get rid of outdated guidance. We need to

2   codify the RIS and the ISG. I mean, when you use a term like interim staff

3   guidance, ultimately, it needs to get into a reg guide.

4   It needs to get into something more permanent that

5   everyone has confidence will last forever, and we absolutely need to allow

6   these internationally accepted standards into our guidance.

7   Next slide.

8   So basically moving digital reviews to a risk-informed

9   performance-based approach will enable reasonable assurance but not

10   necessarily absolute certainty. This is a paradigm shift but it's essential

11   and, obviously, it'll take leadership.

12   When I look at what this leadership team has done both

13   within the staff and the Commission around backfit, I think it set the stage of

14   what can be done to change the culture in an organization, and I think if we

15   use that same kind of impetus then we can make even faster moves with

16   digital.

17   Last slide, please.

18   So, in summary, what we really need more than anything

19   else is a tangible, useable, and endorsed guidance that utilities can count on

20   and have a level of confidence that if they follow this path they will have an

21   outcome that can be assured in a way that they will make the necessary

22   financial investments.

23   That's all I've got.   Thank you.

24   CHAIRMAN SVINICKI: Thank you, Mr. Pitesa.

25   Next, the Commission will hear from Mr. Frank Novak, who

26   is   a   senior   systems   engineer   with   GE   Hitachi   Nuclear   Energy,

1   Instrumentation and Control Group and he is also chair of the IEEE Nuclear

2   Power Engineering Committee Working Group 6.3.

3   And although he chairs the IEEE Committee 603 it's my

4   understanding he doesn't strictly speak in that capacity today.

5   MR. NOVAK: Yes, ma'am. Thank you.

6   CHAIRMAN SVINICKI: Please proceed, Mr. Novak.

7   MR. NOVAK: Okay.   Well, thank you, Chairman, and

8   thank you, commissioners, for this opportunity to speak on such an important

9   topic.

10   Next slide, please.

11   This slide shows my outline that aligns closely with the

12   topics that appear in the agenda except the second major bullet.   I included

13   a slide that provides the status of 603.

14   Next slide, please.

15   Okay.   Slide 3 covers the recent experiences with

16   licensing of digital modifications.   GEH provided the same digital

17   safety-related product based on the same approved licensing topical report

18   to various sites in the U.S., some before and some after ISG-06.   So we can

19   quantify the impact of ISG-06.

20   The second bullet to the left describes some of the ways

21   that ISG-06 affected the scope of the amendment request and the graph to

22   the right shows how the review times increased.

23   Everyone here is aware that licensing digital products

24   became difficult.   So I don't think I need to belabor these points.

25   Instead, I'd just like to highlight what's under the third bullet

26   over to the left about the causes.

1   First, the increased scrutiny on software development was

2   a major factor.   Based on the guidance the licensees had to provide a lot of

3   information about the software development process that we, as their

4   vendor, was going to use and then the NRC reviewers, also based on the

5   guidance, not only had to review that information but also check our

6   adherence to the process and the creative coupling between the project

7   schedule and the licensing schedule.

8   And it basically ensured the negative outcome that you

9   could not get approval until after the project would otherwise be completely

10   done.   So this requires a lot of calendar time and created risk during the

11   projects.   I am going to return to this during slide 5.

12   The second bullet is about the IEEE standards.   At least

13   during our experience we did not find that meeting the criteria in the

14   standards caused the licensing difficulties.

15   I bring this up because SECY 18-   16 could lead a leader

16   to believe that the IEEE standards are what caused the difficulty.   But we do

17   not find this to be the case.

18   In fact, we were using basically the same IEEE standards

19   prior to ISG-06 when licensing was not viewed as a major project risk.

20   After ISG-06 we had to show compliance with some newer

21   versions of the same standards and we also had to show compliance with

22   IEEE 603 instead of 279.   But the effort was reasonable.

23   So based on our experience, it was the scrutiny of the

24   software development, not the IEEE standards that introduced the difficulty.

25   And the last comment I'd like to make is what appears at

26   the bottom of the slide.   We really appreciate what's going on with the

1   initiative to revise ISG-06. We look forward to some positive outcomes and

2   appreciate the sense of urgency.

3   Next slide, please.

4   Slide 4 gives the perspective on the staff recommendation

5   to endorse alternatives to IEEE and I think I am basically just going to echo

6   the previous speaker here.

7   We strongly support the idea. The graphic gives them

8   thoughts on how alternatives could benefit potential users and the graphic

9   draws a distinction between the existing plants in the operating fleet and also

10   new plants.

11   So for new plants the alternative process could be

12   especially appealing if it becomes unnecessary to create multiple designs

13   and regulatory justification packages.

14   Vendors could leverage their work in multiple locations

15   and, as a result, there would be efficiency and competitive prices for the

16   licensees and similarly, for the operating fleet down at the component level

17   replacements endorsed alternatives would be very appealing. It could

18   streamline the process for installing high-quality components including those

19   from vendors who currently do not pursue business in the U.S. nuclear

20   market.

21   So the yellow box in the upper right is about system

22   modifications at operating plants. It is yellow because it could be difficult to

23   justify the cost of the transition to an alternative.

24   The plants are already familiar with their licensing basis

25   and most of the vendors' approved development processes, as far as I

26   know, are based on the current standards.

1   Also, I mentioned in the previous slides that we did not see

2   that meeting the IEEE standards was a source of the problem.   So a

3   transition to something different would be possible but it would come with

4   cost and risk at least in the initial projects.

5   So, overall though, we definitely do welcome very much

6   having endorsed alternatives.

7   There is just a few more bullets under the graphic I'd like to

8   touch on, though we would not expect quality or safety to go up or down

9   because of the alternatives.   They are both excellent.   Second, when we

10   say it's appealing this presumes that the alternative standards will have

11   clean endorsements.

12   If they are cumbersome, like the current ones, it's also not

13   going to be easy to use.   And the third is since we will continue to use the

14   current process for a while it remains very important to get ISG-06 revised.

15   Next slide, please.

16   Slide 5 covers two related topics in digital I&C licensing

17   and the first is right from SECY 18-0060.   It has to do with transitioning the

18   review of the software development process out from the NRC I&C branch

19   and into the QA branch.

20   And if I understand correctly, the software development

21   would be treated more like other aspects of an NRC-approved QA program.

22   This really could go a long way to remedy the problems

23   that I was discussing earlier with all of the scrutiny on the software

24   development process and the effect on schedule.

25   It isn't so much who's doing the review but the fact that

26   you're taking it out of the project by project basis to get your software

1   process reviewed and approved.

2   This could really reduce significantly the schedule pressure

3   that projects feel and also the risk that it might ultimately not get approved.

4   ISG-06 revision is taking some good steps in this direction

5   so I would encourage the NRC to implement this idea fully and I'd take a

6   page out of what Bill Pitesa said and codify it in something besides an ISG.

7   Also SECY 18-0060 seemed to describe this as something

8   that's associated with rulemaking and endorsing alternatives. But I would

9   encourage you to disassociate it from those potentially time-consuming

10   initiatives and pursue it in parallel.

11   The second topic on this slide is about harmonization of

12   standards. The industry is already driving an initiative to close the gaps

13   between IEEE and IEC standards.

14   We are doing this for the same reasons we would welcome

15   alternatives. Harmonized standards enable leveraging and should lead to

16   more competitive pricing.

17   Several nuclear standards already are issued with the joint

18   IEEE and IEC logo. I've listed some of them there and others are in

19   progress.

20   So now that the NRC is considering endorsing alternative

21   standards such as IEC standards, it seems like it would be in their interests

22   also to support harmonization between IEEE and IEC. It should lead to

23   efficiency within the NRC because a single endorsement would apply to both

24   IEEE and IEC.

25   And this also - this supporting harmonization could begin

26   essentially immediately without waiting for rulemaking or endorsement of

1   alternatives.

2   Next slide, please.

3   Okay. Slide 6 provides a status of IEEE 603. We are

4   very close to issuing the next revision. It should bear the year 2018 and get

5   issued.

6   It addresses the concerns that the NRC communicated to

7   IEEE after the rulemaking effort. So if you do decide to revise the rule, then

8   continue to leave 603 incorporated by reference. At least those issues are

9   not a concern.

10   We did not address or even consider the issues raised in

11   the SECY because they were not known to us at the time.

12   Next slide, please.

13   Okay. In summary, I discussed the recent difficultly with

14   licensing digital - the licensing of digital modifications and, from our

15   perspective, it was not the IEEE standards but it was the scrutiny in the

16   software development process that made it difficult and time consuming.

17   I discussed the staff recommendation to endorse

18   alternatives such as IEC. I think it's a great idea. It would be a great

19   benefit to the industry especially for new plants and for component-level

20   replacement at our operating plants.

21   I also urge the NRC to proceed with their own idea to

22   transfer the review of software development into QA and consider supporting

23   standards harmonization.

24   And finally, I just gave the status of 603. That concludes

25   my presentation and thank you again for the time.

26   CHAIRMAN SVINICKI: Thank you very much, Mr. Novak.

1   Next we will hear from Mr. Clayton Scott. Mr. Scott is

2   senior vice president and deputy for global I&C business for Framatome, Inc.

3   Please proceed, Mr. Scott.

4   MR. SCOTT: Thank you, Chairman and Commissioners,

5   for allowing me to be here and speak.

6   I am going to take a little bit of different view on some of

7   this. I know that Bill and company have focused a lot on what we have

8   done on the standards perspective.

9   I am going to talk a little bit more about technology and

10   what's been done and what we could be doing, et cetera

11   Clearly, digital has been used in the nuclear sector for a

12   long time. I came under the Pickering fleet in Canada so in '79, '80s we

13   were using digital systems.   So it's nothing new, right.

14   So a lot of agencies, a lot of industries have a lot of

15   publications.   There is a lot of substantiated licensing positions that have

16   already been developed.

17   A lot of plants are using digital worldwide.   Even in the

18   U.S. we are seeing a substantial amount of upgrades, not necessarily on the

19   safety-related side but on the nonsafety-related side.

20   Next slide, please.   Continue.

21   Just showing a representation.   This is just some plants

22   that we recently have completed.   One of the things I wanted to point out is

23   that even though we have performed work in these units in China, a lot of

24   that regulatory basis was based off NRC guidance.

25   Matter of fact, one of the individuals that we worked with at

26   CNNC actually did significant amount of training with the staff.   He spent a

1   six-month stint here.

2   So the view and the respect of what the NRC brings as a

3   guidance perspective is used globally and we seem to struggle here in our

4   own position.   So it's a little bit of an interesting aspect.   So I just wanted to

5   kind of point that out.

6   The other thing I think is important and I think we are not

7   really focusing and giving credit to technology.

8   Technology is very strong and I think, when I listen and I

9   sit on the commissions and the different committees that we have to discuss

10   over the years, there is been a lot of focus on the technology itself and the

11   lack of its performance or the worry of some of its performance.   And to me,

12   I think we are missing some of that aspect.

13   Technology is very strong.   Technology is strong in all

14   tech sectors.   It doesn't really matter whether it's nuclear or whether it's not

15   nuclear.   It's technology.

16   I think we are missing some of that.   We have got - we

17   have got platforms out there that have over billions hours of operation

18   without failure on demand.

19   So there is a strong basis for us to be focused on what's

20   available.   There is significant PRA space with some of the technologies

21   that's being utilized.

22   So I think we need to move towards more of a risk

23   informed position and maybe not be so focused on what is the - what is the

24   widget able to do or not do.

25   Next slide.

26   Okay.   Just as an example, not nuclear but, again,

1   focused on technology, Reliance Petroleum is the largest control room

2   operation system in the world.   It's 180,000 I/O points.

3   It's operated with a very small staff but it's very critical

4   systems.   Even though it's not a nuclear plant, it's one of the most volatile oil

5   and gas plants in the world and it's been reliant on technology for years.

6   So it's just - I just think, again, you know, there is a lot of

7   developments.   We are not buying - you know, the suppliers that are in this

8   industry are providing products that are satisfactory to other regulatory

9   positions.

10   They've gone through TUV, SIL4 applications.   They are

11   used for safety-related systems in other sectors.   So I just think we need to

12   understand that.

13   Next slide.

14   Outside the U.S., as Bill mentioned, there is a lot of

15   regulations based on IAEA, IEC, IEEE, NRC guidance all combined.   But it

16   seems that we are not necessarily taking the benefit of some of those

17   positions as well and I think we need to look at what's being more globally

18   utilized.

19   And I know MDEP was looking at harmonizing a lot of

20   regulation.   But I think we just need to have a little bit more focus on what's

21   being done elsewhere - how can we apply it here.   A little bit more focus.

22   Common cause failure - it's not common.   It's a little play

23   on the words.   Sorry.   But I understand this has been a very challenging

24   subject over the years.

25   It seems to be the main technology subject that we seem

26   to focus on a lot of times.   But in reality there really hasn't been any

1   significant common cause failure events across different sectors. I mean,

2   there have been some. But it's not something that I think is to the alarm of

3   concern it should be.

4   I think there is measures that we can be putting in place to

5   mitigate against it that are sufficient. So I think we - I think we need to step

6   back on common cause failure discussion.

7   There is a lot of diverse technologies in place and how we

8   apply those diverse technologies I think we can satisfy some of those risk

9   mitigations around CCF.

10   Next slide.

11   So I think we have done a lot of things. I think Bill has

12   pointed out we have - you know, I think the NRC and the industry we have

13   moved quite a bit in the last few years and that's encouraging.

14   But I do think we need to figure out a more expedited way

15   to allow for modernization and I think the new guidance should be structured

16   to benefit the technologies so that we can get these systems in because

17   then we can mitigate trips.

18   We can mitigate entering LCO space. I mean, there is a

19   lot of benefits to having these in the plant. We can reduce surveillances so

20   you're not putting your plant at risk.

21   You're not putting it in a position where it could potentially

22   trip. So you're actually allowing your plant to be cycled less and put

23   yourself in a much safer operation, from that perspective.

24   We have got a strong amount of knowledge and design

25   processes that are well advanced. As far as I am concerned, I think a lot of

26   the standards in place are sufficient and are very strong.

1   I just think that we get diverted sometimes on some of

2   these topics that allow us to derail some of the progress. But I think,

3   overall, we should be focusing on final design, not necessarily trying to have

4   the staff drive detailed design processes. I think we should be looking more

5   at what's the end game and how is it truly going to operate in a safe manner.

6   Next slide.

7   Again, I think we talked about it earlier. I think we need

8   more leveraging of different standards practices. We need to incorporate

9   more into the regulatory framework.

10   Again, I think we should more risk insights into I&C

11 regulations. I think there is a lot of emphasis placed on software life cycle

12 and, you know, I just think, to Frank's point, we need to look at that again.

13   And I think it's pretty clear in industry that digital is really

14 not the dominant contributor of any failure.

15   I mean, I think there is - I think if you look at digital systems

16 and the plants that use digital systems you'll find that their operations are

17 very safe and efficiencies are very strong, and the benefits that digital brings

18 to the plant from keeping it in a more reliable operation perspective mitigates

19 any risk of cycling it from an accident perspective. So I think we need to

20 focus on that.

21   And then the last slide - we clearly need digital. I think

22 with the SLRs, you know, you're expanding a license. You've got to have

23 something that's sustainable.

24   It's interesting to me when people say digital is out of - you

25 know, you put a digital system in it's immediately obsolete. Well, that's not

26 really the case. I mean, we put digital systems in.

1   Digital systems can stay in for a significant period of time

2   and there is upgrade strategies.   There is modernization strategies and they

3   are not significant impacts to the plant.

4   So I really do think that we need to be able to find a

5   framework that allows the industry to have the confidence to come forward

6   and implement the designs.

7   So thank you.

8   CHAIRMAN SVINICKI: Thank you very much, Mr. Scott,

9   for that presentation.

10   We will pivot our focus a bit with the next presenter.   Our

11 next presenter is Mr. George Romanski, who is chief scientific and technical

12 advisor for aircraft computer software at the Federal Aviation Administration.

13   He will discuss with us approaches for software reliability

14 in critical safety systems and experiences in the aviation sector.

15   Thank you very much for being here today, Mr. Romanski.

16 Please proceed.

17   MR. ROMANSKI: Thank you.

18   We have a proud record in that there has been no hull loss

19 due to software in the aviation sector.   There might have been plenty of

20 accidents, unfortunately, last year, which wasn't software related, but we

21 have never had a software-related hull loss.

22   However, we are not complacent.   We have various

23 sectors.   We have the Part 25, which is the transport planes.   We have Part

24 23, which are the smaller planes.   We have unmanned vehicles, which are

25 growing very quickly right now.

26   We see - so while we have a good record, we have

1   tremendous pressure to try and reduce cost. People are saying it's too

2   expensive to certify software and software safety systems are not being

3   installed on the small aircraft because they are too expensive due to

4   software certification.

5   So now we have this safety continuum where we have, on

6   one side, the notion that we can install a safety feature on the plane, but it's

7   too expensive under current regulations. So people are leaving it off, and

8   we are trying to address that.

9   So while keeping the safety record, we are looking at

10   streamlining the software certification process.

11   The FAA started an initiative about two years ago with a

12   small team, and now growing slightly larger, where we are looking at the

13   essence of certification we call overarching properties, and we know that

14   when developing software we need to understand the intent of the software,

15   we want to understand its correct implementation, and we want to ensure

16   that we have acceptability.

17   By that I mean that the software doesn't introduce or

18   doesn't introduce - doesn't produce any function which is contrary to - which

19   is unintended and affects the safety.

20   We are looking at building assurance cases. We have a

21   number of research projects and case studies going on. We are working

22   with Europeans on this.

23   On the other side, we have EASA, which is our counterpart

24   in Europe, that are looking at the problem differently.

25   They see a bottom-up approach and they are looking at a

26   definition of an abstraction layer where you extract the essence of

1   certification of software and map that onto existing standards.

2   Their view is that we know and understand. We trust in

3   the current standards - IEC 61508, ISO 26262 and so on. So why not map

4   to those standards and take the benefits of those and just understand what

5   the essence is and make sure that it's covered.

6   We need to harmonize so we have started meetings with

7   them and hopefully we will meet somewhere in between. But it's still - we

8   still have a ways to go.

9   The FAA and EASA are also looking at process

10   harmonization and acceptance. We know that when we go in to audit a

11   project, normally there is so much information in there that our auditors will

12   only sample less than .1 percent of all artifacts produced. It just takes too

13   long to go through everything so we sample.

14   So we take a very, very small sample and when we take

15   the sample what can we do? We can look at the process plans and see

16   how did you produce this.

17   Do you have a defined process?   Do you have quality

18   assurance records that you follow this process in its entirety? And then we

19   take a small sample.

20   And if that small sample is perfect, then we have a leap of

21   faith. We believe that if you've produced the rest of the system using the

22   same mechanisms, and we have evidence that you have, and we like the

23   process that you used and the sample is good, we have a leap of faith and

24   assume that the rest of it is to the same quality.

25   So we are trying to build trust in the applicant in the way

26   we approach applicant approval. We have had a lot of success with what

1   we call integrated modular avionics.

2   This is the notion that instead of having lots of different

3   computers doing their own separate functions we start building central boxes

4   basically like servers and these servers are certified and these servers will

5   host many different applications.

6   This has been extremely successful and it is how most of

7   the - actually all of the new transport aircraft are being built and certified.

8   The idea now is that applicants build applications and they

9   host their applications on a hosted platform.   It means that we can isolate

10   what the application does.   We can configure how the applications work

11   together.   And we can start doing what we call incremental certification.

12   We certify the host box and we can certify the applications

13   one at a time, and if someone wants to replace an application they replace

14   the application.   They don't have to retest the whole box because the whole

15   box has already been approved.

16   This has been used extremely successfully.   It's not

17   moving to the smaller aircraft and it's also moving to some of the larger

18   unmanned vehicles.

19   Of course, technology moves on.   We are looking at

20   distributed IMA systems in the future now and we are doing some research

21   to see if we can have distributed IMA systems in addition.

22   The last most difficult area that we are studying, of course,

23   is artificial intelligence in neural networks.   We find that many of our

24   systems are now based on AI and machine learning.

25   We have one example where an applicant built a fuel

26   management system - a fuel measurement system.   Measuring fuel is quite

1   hard because the fuel sloshes around. The tanks are different shapes

2   around the aircraft.

3   So the applicant built a system and it worked well. Then

4   they built another system using machine learning using exactly the same

5   models to teach the machine learning algorithm how to measure the fuel.

6   The resulting system was smaller, faster, and produced

7   better results. We couldn't use it because we don't know how to certify it

8   just yet.

9   We have a similar example with collision avoidance system

10   where we have an ACAS XU system where we can measure or do collision

11   avoidance systems. System works, performs better. We don't have

12   certification evidence for it.

13   So we are struggling with this. There are working groups

14   that are working on achieving this but that's our goal for the future.

15   Thank you.

16   CHAIRMAN SVINICKI: Thank you very much for that

17   presentation.

18   For the final presentation for this panel, we will hear from

19   Dr. John Thomas, who is a professor at the Massachusetts Institute of

20   Technology, and he will provide expert views on addressing common cause

21   failure, evolving digital technologies, and perspectives on regulatory

22   acceptance of digital technologies.

23   Dr. Thomas, please proceed.

24   DR. THOMAS: Well, thank you.

25   I am a researcher at MIT. I want to talk about lessons

26   learned across industries in implementing digital I&C.

1   Next, please.

2   To solve this problem, we have got to understand the

3   problem that we are solving. That's the biggest issue that I see a lot of

4   misunderstanding about what the problem is.

5   We have got to understand there are two basic types of

6   accidents and they are both affected by the introduction of digital

7   components.

8   We have got accidents caused by component failures at

9   the bottom here. Traditionally, this hasn't - this is very well understood, well

10 recognized.

11   For the engineers in the audience, I am using the

12 engineering definition of failure where a component does not perform - does

13 not operate as specified or does not perform its intended functionality.

14   Basically, components break. That could cause an

15 accident. We know that. This is under our belt, very well understood. We

16 have very good methods to deal with component failures and component

17 faults and rigorously analyze the system.

18   There is another type of accident that we should be

19 concerned about. This is a non-failure accident, particularly devious in the

20 system.

21   Traditionally, 50 years ago it hasn't been a very big

22 problem. But this can occur. It is possible. It happens when every

23 component behaves exactly the way it was designed, exactly the way we

24 required it and exactly the way every one of us intended that component to

25 work, but we still had an accident.

26   This is particularly devious because it slips through the

1   crack sometimes.   Now, 50 years ago this wasn't a very big problem

2   because what happens is systems were not very complex and it worked.

3   We can basically get these out by inspection.

4   We can do things like hire smart people, do design

5   reviews.   We have subject matter experts do a careful assessment.   We do

6   some basic things like a requirements traceability matrix.

7   But as long as the systems are sufficiently simple, as long

8   as we don't have too much digital I&C we can basically flush these out

9   almost by inspection.

10   The critical thing is though in every industry that has had

11   an influx in digital components - I understand nuclear is a little behind other

12   industries when it comes to this - what we have seen is a fundamental shift.

13   Next slide, please.

14   These two kinds of - sorry, previous - there has been a

15   fundamental shift in the type of accidents that we are seeing.   We have

16   gotten so good at the component failure problem virtually all of our methods

17   today are targeted at this problem and do a great job.

18   But what's happening more and more of these systems are

19   having non-failure accidents, particularly when we have introduction of digital

20   I&C.   This is directly related to the complexity of the digital software and

21   computer systems that we are introducing.

22   This is the problem that we have got to solve if we are

23   going to move forward and this is what other industries have been struggling

24   for a lot longer than we have.

25   Next slide.

26   This is very well understood in academia and in industry.

1   For example, Fred Brooks, the world famous computer scientists, writes the

2   single hardest part of building a computer system is not actually building it.

3   It is deciding precisely what to build.   That is the problem

4   we have got to solve.

5   Lots of studies have been done in the last 20 years to look

6   at the causes of accidents due to computer digital systems and software and

7   they have found that the vast majority of accidents in these systems have

8   been caused not by a software bug or an error in the logic in the digital

9   system or the system doing something bad but a system that perfectly

10   satisfied the wrong requirements.

11   It did exactly what we thought it should do and we were

12   wrong.   That's the problem.

13   Go back to the slide, please.

14   And the last thing that we found is from Daniel Jackson.

15   He said as is well known, at least in the software engineering community, by

16   far the largest class of problems arises from errors made in the listening,

17   recording, and analysis of requirements.

18   It is not these software bugs.   It is the fact that it did what

19   we told it to do and we were wrong.   That's the problem we have got to

20   solve.   It's directly related to complexity.

21   Next slide.

22   We also get the same thing from Joe Miller.   He says - by

23   the way, he's a chairperson for Functional Safety Standard World.   We used

24   internationally worldwide in the automotive industry.   You cannot buy a car

25   that has not followed this standard.   He recently retired.

26   He said, in my experience requirements are much more

1   important in today's systems than preventing hardware failures.   Recalls -

2   safety recalls in modern systems are rarely due to component failures

3   anymore.

4   Typically, it's due to missed requirements, requirements

5   never verified and missed interaction with the supplier.

6   This is the future of digital I&C if we are not careful.   We

7   should learn from these other industries and what they've found.

8   The FAA - next slide - has found in their top five list of

9   common pitfalls in the safety analysis is paying more attention to crunching

10   probabilities than to the physics of the problem.   This is fundamental, a well

11   learned lesson in this industry.

12   I think you can spend all day crunching the probabilities

13   but if you made a bad assumption and you don't recognize that you're

14   missing a requirement it's never going to show up in the analysis methods.

15   That's the problem that we have got to solve.   Now the

16   good news is we do have solutions to this.   I am going to get there in a

17   moment.

18   But I think for a moment I need to talk just a moment about

19   nuclear.   I've been talking a lot about other industries.

20   Already we have digital components in the nuclear industry and

21   already with the meager attempts that we have made we have - are seeing

22   the exact same patterns and trends in this industry.

23   Forgive me, I am going to put on the engineer hat just for a

24   moment.   Then I'll come back.

25   Next slide.

26   This is a HPCI flow control system that I want to talk about.

1   I think it's really important to understand the type of problem that we are

2   having.

3   HPCI, as you know, is a critical system in nuclear power

4   plants that provides emergency water cooling systems.   It simply has to

5   work on demand and that's the way it's designed.

6   By the way, this is a real event.   It happened - a real OE in

7   the U.S.   I am not going to tell you where it was.   I am not going to tell you

8   enough information to figure it out.   That's not what matters.

9   What matters is we have got to understand the problem.

10   This operator sends a system initiation signal on the right.   It comes down, it

11   kicks the blue part, which is the digital upgrade in this system, to start

12   opening valves and you get your emergency cooling.   Works great.

13   Next slide.

14   One of the considerations when this thing was designed is

15   ramping up the turbine is a concern.   If we ramp it up, open the valves too

16   quickly - ramp that thing up too quickly we can cause damage.   There is a

17   safety implication.

18   So on purpose we put protective functions in place in the

19   digital system to make sure that never ever happens.   Did a great job with

20   that.

21   Next slide.   Click four times, in fact.

22   What happened is this thing was implemented on day one,

23   tested, of course, and it worked beautifully.

24   Now, we have to - these don't get used very often - we

25   have to test them every year.   A year later it was tested and we found that

26   there was a flaw in the design of the system that would prevent it from

1   working that nobody had recognized.

2   On this day there was a rolling start. You see the blue

3   line and the turbines start. Click a couple more times, please - I think three

4   times.

5   You see - once more - you see the blue line. We had a

6   rolling start. In that situation if you hit the button to do an emergency

7   cooling in a rolling start - and this was what was never conceived - what

8   happened that the system initiation signals that gets sent - what happens is

9   the valves start opening and we hit a trip set point at a thousand RPM. That

10   digital system uses that trip set point - click once more - uses that trip set

11   point to figure out if we are ramping up too quickly. If you hit that trip set

12   point too quickly it says oh no, you're going to cause a problem - we are

13   going to shut down the digital system.

14   Now, what was never conceived was that this could

15   happen during a rolling start. And so the rolling start meant that we hit this

16   trip set point quicker than usual.

17   Now, it turns out nothing - there was no problem with the

18   system. It's perfectly fine, perfectly within tolerances. Could have started

19   up just fine. But the digital system didn't know any better because it was

20   never designed with the understanding that there could be a rolling start.

21   All it was looking for is did we hit the trip set point too

22   quickly. The safety feature that we put in there on purpose was having this

23   unanticipated effect.

24   Of course, everything I am telling you is not what the

25   operator knew. All the operator knows is I need emergency cooling - I am

26   hitting the button and the digital system comes up and overrides and shuts

1   the thing down.

2   The operator hits it again, to emergency cooling.   This

3   thing tries and the digital system immediately comes up and shuts the thing

4   off, and you try it again and you try it a hundred times, you get the same

5   result because we designed it to work that way every time.   But it was a

6   failure of foresight on our part, not a failure of the digital component.

7   This is the problem that we have that we need to solve if

8   we are going to introduce digital I&C.

9   Now, I have great news for you.   The problem has been

10   solved.

11   Next slide.

12   The group at EPRI has done great work on this.   There

13   are number of methods.   One of them is called STPA, which I am

14   particularly partial to.   But EPRI did an experiment about three years ago.

15   They took an OE - a real OE in a real system with real

16   complexity of things that this - the exact example.   Gave it to a couple

17   students.   Didn't tell them what the problem was.

18   Just gave them a basic description of the system and

19   wanted to test whether this method could uncover the flaw early and in fact it

20   did.   A couple of students with virtually no experience in less than a week

21   working part time found it.

22   Next slide.   Click twice.

23   Pinpointed exactly this flaw. Very little work needed.   So

24   this is great news.   We have solutions to this problem.

25   Next slide.

26   And here's some other standards that also solved this that

1   has been introduced in other industries we should take a look at.   You can

2   see STPA is particularly popular.   As I've said, I am very partial to that but

3   it's not the only method out there.

4   Look, here's the bottom line.   If you didn't hear anything I

5   just said, listen to this.   The danger in the path forward is - the problem is

6   that we have got a number - everybody's got a method and they've got a

7   proposal to fix this problem.

8   We have got to do a proper test.   Good news is there are

9   some solutions out there already that are working, that are tested and being

10   adopted in other industries.

11   The bad news is there are lots of proposals being made

12   that have never been tested and that, frankly, do not work.   We have got to

13   do a proper test.

14   What does a proper test look like of these methods before

15   we make any recommendation of policy or standard, right?

16   Well, this has been done in other industries and we should

17   follow EPRI's lead.   What a proper test is not is we do not take a problem in

18   hindsight and stuff it into a fault tree and say look, our existing process

19   already works - there it is.

20   You do not take it and stuff it into a CCF and you don't take

21   it and stuff it into an STPA in hindsight because we do not have a problem.

22   We are writing things down in hindsight.   We have a fundamental problem

23   of foresight.

24   That's the nature of the problem.   We have got to do a

25   proper test and we have got to take a couple of engineers who don't know

26   what the problem is.

1   We have got to see if they can learn and use the method.

2   You can have the best method in the world but if it's not - and presented by

3   people with impressive credentials from MIT - but if it's the best method in

4   the world and people can't learn it and can't use it it's useless.

5   So we have got to take real engineers. We have got a

6   rich set of OE in this industry of things that have already slipped through the

7   cracks that we know are not being caught and have undergone all the

8   processes that we have - take engineers, try these methods and we will find

9   out very quickly, I think, what works and what doesn't work and that needs to

10   be the basis for the policy and recommendations of standards that we

11   produce.

12   EPRI has done great work. As I've said, we need to

13   follow their lead, in my opinion. I am not against technology at all. In fact, I

14   am completely in line with what has been said.

15   We need to make risk informed decisions and the risk is if

16   we don't make an informed decision we have just employed a method - a

17   crazy proposal. Just change the semantics. Just redefine the word failure

18   and then the existing method is going to work.

19   No, we need to do a proper test and find out what works

20   and what doesn't, in my opinion.

21   Thank you.

22   CHAIRMAN SVINICKI: Thank you very much, Dr.

23   Thomas, and thank you to all the presenters. I think it was very interesting

24   presentations today.

25   As is the practice of our Commission, we rotate to the

26   order of recognition for questions and we begin today with Commissioner

1   Baran.

2   Please proceed.

3   COMMISSIONER BARAN: Thank you all for being here.

4   We really appreciate it.

5   As a few of you referred to in your presentations, as part of

6   that staff's transformation initiative the staff recommended moving away from

7   the IEEE standards and initiating a rulemaking to define high level of

8   performance-based digital instrumentation and control safety design

9   principles.

10   Initially, I saw digital I&C as a strong candidate for taking a

11   whole new approach from what we have been doing because it has proven

12   to be so challenging in this regulatory area.

13   But recently I've had several stakeholders express their

14   concern that a rulemaking could shift focus away from the current efforts to

15   improve key guidance documents just when significant progress is being

16   made on them.

17   I think slide 4 - Bill's presentation - provides a pretty good

18   overview of these efforts.   It has the six of them there.

19   All my questions are for anyone on the panel who wants to

20   express a view, and my first question is do you share this concern that I've

21   been hearing from some about losing momentum on the guidance updates if

22   we initiate a rulemaking in the near term.

23   Do folks have thoughts about that?

24   MR. NOVAK: Yes, I'll talk to that. That's actually one of

25   the things I was - maybe I didn't articulate it clearly, but I am concerned that

26   if there is a lot of emphasis on the rulemaking and all this, you know, the

1   rulemaking endorsing alternatives, that the other stuff is going to sort of die

2   on the vines and, you know, I said it's going to be very important to get

3   ISG-06 out and get some - get some run time with that.

4   So yes, I think we need to keep - you know, keep making

5   the existing process better while we are trying to develop something that's

6   completely different is what I would say.

7   COMMISSIONER BARAN: Do others have thoughts

8   about that?

9   MR. SCOTT: I agree.

10   COMMISSIONER BARAN: You agree?   Okay.

11   MR. PITESA: The piece I would just echo, again, is as we

12   move forward with ISG-06 and moving the approval to earlier in the process

13   versus later in the process but also reflect back, because I am not sure I am

14   the technical person to address all aspects of your question, but at the same

15   time what we can do more with international standards and looking at how

16   our standards compare to those.

17   The experience we had at Oconee particularly was we had

18   - we used technology that had been really accepted all over the world except

19   here and then we modified that program to the extent that it became

20   untenable to almost - to install.

21   And so I think we have to be so careful on the path forward

22   with regulation that ultimately it leads to a better outcome and doesn't have

23   the unintended consequences.

24   COMMISSIONER BARAN: Part of what I am trying to

25   figure out is when I look at the list of these guidance document efforts, trying

26   to unpack that a little bit and understand if all five of these on the - you know,

1   this transforming culture - to put that aside for a minute and look at the five

2   guidance document efforts - if these five were all completed, do we think that

3   effectively resolves the key issues or does that provide the regulatory

4   certainty the licensees are looking for to do an upgrade or do we see those

5   guidance documents as more of a short-term fix?

6   MR. ROMANSKI: In our experience, technology moves

7   too fast.   While we had DO-178C, which is our guiding document for a long

8   time, we upgraded it.

9   It took seven years to update it to DO-178C and we

10   produced four supplements - you know, one to cover model based, one to

11   cover object oriented and one to cover former methods, and as new

12   proposals for additional standards or additional supplements to cover

13   technology that is coming up.   So technology moves and we need

14   supplements to keep going.   Not rewrite what we have but make it

15   additional.

16   COMMISSIONER BARAN: Do others have thoughts

17   about this - about whether these - you know, is this the - are all the effort

18   being expended on these guidance documents, here everyone is saying it's

19   very valuable.

20   I am trying to understand how valuable is it?   Is it - is it

21   basically going to solve the problem or is it - it's a Band-Aid?

22   MR. NOVAK: I would say it is very valuable but you still

23   would want to go ahead with endorsing alternatives and so forth.   I would

24   look at it as not the end - the end solution.

25   I look at it as making digital more viable in the near term as

26   the way I would look at the current initiatives.

1   COMMISSIONER BARAN: Okay.

2   MR. PITESA: And I would echo the exact same thing. I

3   believe all aspects of what you see here are going to be principally under the

4   control of the staff.

5   But if you look at the transformation papers some of the

6   additional activities that are being discussed there under Dan Dorman's

7   paper indicate that we have just got to advance further on the acceptance of

8   more standards and international standards that have such an amount of run

9   time that we just don't have here in the states.

10   MR. SCOTT: The other thing too is that bringing in that

11   harmonization across that helps the supply chain, right, because the supply

12   chain - if they can - if they can satisfy to something that is more consistent

13   then you have less risk of differentiation on platforms.

14   COMMISSIONER BARAN: One of the things I am trying

15   to think through is the sequencing of all this and when it makes sense to

16   make a decision about whether to initiate a rulemaking.

17   One option is all these efforts are going on and we decide

18   now we are going to initiate a rulemaking but not actually do the rulemaking

19   in the short term.

20   That strikes me as somewhat odd but I guess we could do

21   it.   Another approach would be we focus on completing these guidance

22   documents. We see how far that gets us and then we make a decision

23   about whether to proceed with the rulemaking and what the rulemaking

24   would look like.

25   Do folks have views about kind of the sequencing of how

26   we would address these things?

1   DR. THOMAS: I've got a very strong view.

2   COMMISSIONER BARAN: Yeah.

3   DR. THOMAS: I think baked into this process that we

4   need to include some kind of test and evaluation to see if it really works.

5   I don't know all the details.   Maybe someone here could

6   tell me.   But typically these things get put into practice either based on

7   expert opinion or by arguing that it will work.

8   We need to do an evaluation.   We need test it.   We have

9   a really rich set of OE - of things that went wrong that nobody anticipated

10   and whatever we propose we need to have real evidence.   Not an opinion,

11   we need to have evidence.

12   I think it's very easy to do but it's often not included to

13   collect that evidence.   We need something to collect that evidence and try

14   them.

15   COMMISSIONER BARAN: Thanks.

16   Other thoughts on sequencing and - or not so much?

17   MR. PITESA: I think it's a great question and I was just

18   reaching to a friend in the audience, Dan Dorman.

19   But, ultimately, on - I think the next panel's going to maybe

20   have the opportunity to discuss this a little bit more on the intricacies of what

21   this will provide versus what rulemaking will provide.

22   COMMISSIONER BARAN: Part of what I am trying to do

23   is peer into the future a little bit and imagine a world where over the next

24   couple of years we make very good progress on these guidance documents

25   and they end up being good guidance documents and they provide both

26   applicants, licensees, and the staff with a clear path about how do we make

1   sure digital upgrades have a framework that ensures safety but provides

2   people regulatory certainty.

3   And if you kind of think for a moment, okay, let's say we

4   achieve that goal, part of me does have a hard time imagining someone

5   wanting to be first in line for then adopting a whole new system - you know,

6   to me that first application under a whole new system under a new

7   rulemaking.

8   Maybe if it's, you know, a purely voluntary thing and we are

9   contemplating different standards someone would want to give up the

10   certainty that has been obtained over those years.

11   But given the struggles we have had, I wonder whether

12   that would really happen.

13   Do people have thoughts about that?

14   MR. PITESA: You know, I think the reality is, speaking

15   from a utility perspective, no one wants to be first in line, particularly on

16   things like this.

17   We experienced that with Oconee and it was very, very

18   challenging.   So I think we are going to be looking at international

19   implementation that's been going on, new reactor implementation, and, you

20   know, what has Vogtle installed, how well is it doing, and I think that

21   operating experience will give the confidence to consider implementation.

22   And so ultimately what we have got to agree to is things

23   that are used in advanced nuclear, in other plants in other countries that we

24   can look at that operating experience and say this is tangible, it's real.

25   We know about what cost is and when we bring it to the

26   United States it's not going to explode in cost in ways that we have seen in

1   the past, and I think that will be very important.

2   But I don't necessarily know that we - that the existing

3   operating fleet is going to be the very first in line for absolute new aspects.

4   COMMISSIONER BARAN: I was - I read the staff's

5   Transformation paper I think the same way Mr. Novak did in terms of saying

6   the staff's view was that the IEEE standard is too prescriptive and that's

7   causing a lot of problems.

8   You've kind of expressed a different view, which is maybe

9   it's more the guidance in what the - not so much the standard itself but the

10   staff's kind of approach under the guidance that's created.

11   Do folks have a view about that?   I mean, if we are kind of

12   looking at what's the - what's the challenge here, is it something about the

13   IEEE standard itself?   Is it the staff's guidance being too prescriptive?

14   What's gone wrong?

15   MR. NOVAK: Yeah.   Well, the modification that we did

16   was much more narrow than something like our reactor protection system.

17   So maybe that is something take into consideration.

18   But no, we definitely did not see the standards themselves.

19   You know, I did mention on one of the slides that, you know, looking for

20   clean endorsements on the - you know, these other - whatever these

21   alternatives are, IEC or whatever, for example, not taking exception to the

22   standards in - you know, when the reg guides are written not taking

23   exceptions would be helpful so that you're not changing should to shall and

24   things like that.

25   And also I would say a less rigid attachment to the - to

26   specific versions of the standards would help.   You know, a new standard

1   comes out and people design things to the new standard and then - but

2   you've got to go back and show how it complies with an old version because

3   that's the one that happens to be endorsed.

4   It does get cumbersome trying to show all of that.

5   COMMISSIONER BARAN: Well, so what I glean from this

6   is for the folks who are kind of knee deep in this on the nuclear side you do

7   think there is some value in doing a rule.   Not clear when but, you know,

8   doing something more transformative here.

9   And it sounds like the basic vision for that rule in your mind

10   is a rule that allows a licensee to use any one of a number of established

11   standards in this area rather than just the IEEE standard.

12   Is that the basic vision for the rule you're -

13   MR. NOVAK: Yes.

14   COMMISSIONER BARAN: Okay.

15   MR. NOVAK: Flexibility.

16   DR. THOMAS: That's what's usually done in other

17   industries.

18   COMMISSIONER BARAN: Okay.

19   MR. PITESA: And I think we are very hopeful around

20   what ISG-06 is going to say.   We don't know for sure what it's going to say

21   and I think that's creating some of the hesitation.

22   But moving the approval to earlier in the process is going

23   to be a game changer, I think, for the industry.

24   When I think back on Oconee, we were - we had probably

25   already spent over $100 million and still didn't have approval to say, you can

26   install this widget, and because we weren't checking all the software until the

1   end of the process and we were incredibly concerned that we had gone out

2   on a limb too far.

3   And there was a serious discussion of, even at that point,

4   cutting it off because without that early approval you had zero confidence

5   you're going to get to an outcome.

6   COMMISSIONER BARAN: Okay.

7   MR. NOVAK: Utilities need to have that confidence.

8   Otherwise, they are not going step forward.

9   COMMISSIONER BARAN: Thank you very much.

10   CHAIRMAN SVINICKI: Thank you, Commissioner Baran.

11   Next, we will recognize Commissioner Burns.   Please

12   proceed.

13   COMMISSIONER BURNS: Thank you, and thank you all

14   for being here and for the presentations.

15   It's interesting.   I think this is maybe not as many as

16   Chairman Svinicki but in some capacity, either sitting in that seat or here or

17   there, you know, I've heard the digital thing and I tell you, every time I hear it

18   it's, like - and again, because I am not a technical person, a theme I've

19   emphasized a number of times - but it becomes sort of a veil over my eyes

20   that says what the heck have we been doing for whatever.

21   And I know we should move forward but there are sort of

22   glimmers of hope for my understanding in what you've - what you've said

23   today.

24   One of the things just maybe to build off of what Bill Pitesa

25   just said and also, I think, Mr. Novak said, this looking at how the staff

26   approaches it - that this - and maybe you can help me out - understand that

1   better.

2   So what I seem to hear both from Mr. Novak and Mr.

3   Pitesa is that the focus on the software is something that pushes out so, oh,

4   all right, we got to be there - you got to be able - ready to turn on your

5   machine at the very end, and that focus versus maybe a quality - and I think,

6   Mr. Novak, you mentioned a quality assurance focus would help.

7   But help me understand what - how that - how the problem

8   - what the problem looks like in that way if I - if I've been clear at all in terms

9   of my question.

10   MR. PITESA: Let me start, and I am going to use the

11   anecdotal Oconee example.

12   So we had completely brought all the equipment on site

13   and everything and started working through our factory acceptance testing,

14   and at that point is when really in the process the software was being

15   reviewed.

16   So many things were being reviewed that we thought we

17   were going to be able to install it in a subsequent outage. We ended up

18   having to delay it one if not two outages because of the review time that was

19   still needed.

20   We had a hard time with a vendor on whose cost is this of

21   just sitting here with this product just sitting on the shelf waiting.   And I think

22   so much of that was available earlier in the process and if there had been

23   more acceptance of this followed a level of standards and our QA program

24   verified those standards that we could have probably been much more

25   seamless in our installation at that point.

26   COMMISSIONER BURNS: Okay. Mr. Novak.

1   MR. NOVAK: Yes, I would sort of echo what he said.   If

2   you could picture, you know, you get to a point in the project where you've

3   manufactured the system - you know, the vendor has tested it, you've tested

4   it, did the acceptance test.

5   And then, you know, then the reviewer is following the

6   guidance, reviewed the software process that had been used all along and

7   that takes - you know, can take about a year or so to do that and get the final

8   approval.

9   So now, you know, it's a full year after the system is

10   complete before you can install it and everyone wants to have, you know,

11   sometime in between approval and getting into their design change package

12   and so forth.

13   So it definitely pushes things out - a refueling outage

14   typically.   And so I think it would help, you know, that if the review - if you're

15   reviewing as sort of a periodic ongoing QA type of activity, I am not saying

16   make it easier but just make it - just do it differently and not tie it so closely to

17   the individual project.

18   You know, we are using the projects as the context to

19   approve the software development and that - then that - it just makes it

20   necessary.   If that's the approach that it's really necessary that the approval

21   is going to come very late and it's really - it makes it very expensive and the

22   perceived risk that you're going to get there and a year after the system is

23   built and tested and everyone's ready to install it that something comes up

24   and you got to go back and rework a whole bunch of things and, you know,

25   add a few more years, it just - it's a very large perceived risk.

26   COMMISSIONER BURNS: Dr. Thomas, does this kind of

1   get to your point - I don't know if it does or not - about if you're so focused on

2   - if you're so focused on the software but you're not focused on what the

3   outcomes you're looking for - I don't know.   I am just trying -

4   DR. THOMAS: Yeah, it's a tricky problem because the

5   challenge we have in building a digital system or building a computer system

6   with software it's not actually understanding the software.

7   Software folks are brilliant at understanding the software.

8   The problem is they don't understand the rest of the system.   And the same

9   thing is true for the hardware engineers and for the other engineers.

10   So we need - this is what we have systems engineering

11   for.   I think it's very slow to be adopted in the nuclear industry.   But in the

12   FAA, in aviation and in automotive and other industries they have been

13   much quicker to adopt system engineering.

14   I think that's the solution.   We need - we need methods

15   that don't just apply to component failures, don't just apply to software, don't

16   just apply to digital, or non-digital systems.

17   We need an overarching method that can handle the

18   interactions between all these because the interactions are what get you.

19   COMMISSIONER   BURNS: Yeah.   Yeah.   Mr.

20   Romanski.

21   MR. ROMANSKI: It kind of blows my mind a system can

22   be developed and then submitted for review.   On FAA project - on a project

23   by project basis we have four what we call stages of involvement - the start

24   of the project before the software is developed you develop the plans - the

25   process you're going to use to develop and verify your application.

26   That is submitted for approval and it's at that stage you

1   then say yeah, this works or no, you have to change this a little bit.

2   Then later on we are halfway through the requirement

3   process and we submit 50 percent of the requirements and the code, and

4   then the auditors look at this and said yeah, this looks good - if you carry on

5   like this we should be okay or no, you need to make some adjustment.

6   We do the same thing when you're halfway through the

7   testing.   By the time you've finished the project, the processes you've been

8   following and the mechanisms that you've been using should be sound.

9   So the approval should be a foregone conclusion.   There

10   should be little risk.

11   COMMISSIONER BURNS: Okay.   Mr. Scott.

12   MR. SCOTT: That's a very similar process that we are

13   experiencing in Finland or that we have experienced in Finland with STUK.

14   COMMISSIONER BURNS: With STUK?

15   MR. SCOTT: Yeah.   So they follow a very similar

16   process.   So by the time you actually get ready to implement all of that's

17   pretty much done and reviewed and ready to go.

18   So it's fundamentally similar.

19   COMMISSIONER BURNS: Yeah.   And for those who

20   don't know, STUK - the reference to STUK it's the Finnish regulator - the

21   nuclear regulator.

22   Thanks, Mr. Scott.

23   Bill, did you want to say one more thing?

24   MR. PITESA: Yeah, I was just going to echo what Mr.

25   Romanski was talking earlier about - through the QA process achieving

26   confidence in your processes and then doing some limited sampling.

1   That really resonated with me because I think right now it

2   takes a difference between what I view as absolute certainty which is review

3   every line of code which is review every aspect of the modification versus

4   look at the processes being used and create a level of confidence, and I

5   think that confidence should resonate with us as reasonable assurance.

6   COMMISSIONER BURNS: And the other thing, and this

7   is one I actually - I step back and I will - I may embarrass myself - well, why

8   don't you know that, Mr. Burns.

9   But I am sort of a little bit at a loss, and make sure I

10   understand - what's the disharmony between being able to rely on

11   something other than the IEEE standard? So the recognition within our

12   system at this point.

13   I guess I didn't really fully appreciate that, and again,

14   because I understand fully the ability to look to other standards. I mean,

15   this is much - you know, I started the agency 40 years ago - this is a much

16   more internationally driven industry in terms of supply chain and things like

17   that than it was even back then, you know, in terms of operation and all that -

18   all those types of things.

19   So that's why I am having a little bit - I am trying to

20   understand what's the hurdle, the wall, we have to crawl over here and the

21   difficulty?

22   Mr. Novak.

23   MR. NOVAK: You know, right now, as I am sure you're

24   aware, IEEE 603 is incorporated by reference in the rule -

25   COMMISSIONER BURNS: Yeah.

26   MR. NOVAK: - and then so all of the - the whole - you

1   know, how do you meet this, you know, in the reg guides is all - it's all lined

2   up with IEEE.   I mean -

3   COMMISSIONER BURNS: So I - yeah, I didn't mean to -

4   so otherwise if you're going to deviate from that you're going to have to get

5   an exemption or something like that.

6   MR. NOVAK: Exactly. Yes.

7   COMMISSIONER BURNS: Mr. Scott.

8   MR. SCOTT: Yeah. I mean, NRC guidance has been

9   predominantly IEEE driven.   That's historical.

10   COMMISSIONER BURNS: Yeah.

11   MR. SCOTT: And within recent years they started to look

12   at some of the IEC standards as part of some of the IEEE associations.

13   And then as standards in the industry we are looking at

14   dual coding standards, right, so that we can have, you know, the dual label

15   on IEEE and IEC.

16   But, unfortunately, that takes - the process to get - it takes

17   a long time to get those things mixed together.

18   But I just think that there is just been this fundamental DNA

19   that it's an IEEE-based driven regulatory premise that we just need

20   acceleration or openness to see how much more we can pull in from the

21   other standard bases.

22   COMMISSIONER BURNS: All right. Mr. - Dr. Thomas.

23   DR. THOMAS: There are lots of IEEE standards. I just

24   looked up the one you referenced, IEEE 603 - it appears to establish criteria

25   - single failure criterion for digital systems.   I mean, I am not going to say it's

26   a bad standard.   We should do all that stuff.

1   But I am not convinced that that's the core problem that we

2   have.   The core problem is about the requirements about what should the

3   behavior of the digital system be.

4   There is lots of effort and standards about what's called

5   verification, which is making real sure that it absolutely meets the

6   requirements we wrote.

7   We kind of have that under our belt.   There are many,

8   many standards that do a good job with that.   But what we need to get a

9   handle on is that's not good enough.

10   Making sure it does what we wrote is not good enough.

11   We have got to make sure what we wrote is right.   That's called validation.

12   That's very much - it's not just a digital problem.   It's not a checklist problem.

13   It's a problem of - it's a lack of foresight, like I was saying.

14   So we need - I think we need to go outside that standard

15   and identify methods of getting the requirements right - getting a really

16   robust process - and they exist out there but I don't think they are in that

17   particular standard.

18   COMMISSIONER BURNS: All right.   Thank you very

19   much.

20   Thank you, Chairman.

21   CHAIRMAN SVINICKI: Thank you very much.

22   Next we will hear from Commissioner Caputo.   Please

23   proceed.

24   COMMISSIONER CAPUTO: Thank you.

25   I'll start by associating myself with my colleague's remarks

26   about just the duration of this issue - the frustration and struggling with this

1   issue.

2   Commissioner Burns, your eyes may glaze over. So do

3   mine, and I am a technical person.   I think, particularly as a new

4   commissioner, it's a challenge to dive into this issue because it's a 30-year

5   history. All the questions have probably been asked before. I shouldn't

6   even say probably.   We have been at this a long time.

7   So predecessors that have sat in these chairs have

8   wrestled with this issue before and so it's a challenge for me. So my

9   questions, I am sure, are not original. But I think in tackling this issue, for

10   me, I need to begin with what's important here - why is it important that we

11   pursue digital I&C - why is it important for the agency to reach beyond its

12   comfort zone with analog and wrestle with this issue.

13   So in that vein, Mr. Scott, Mr. Pitesa had a slide that was

14   pretty compelling about digital being more dependable than analog and

15   posing fewer plant challenges which can be interpreted that digital is safer.

16   Can you describe in more detail some additional examples

17   of how digital I&C can improve safety?

18   MR. SCOTT: Okay. So it's a good question.

19   So I am not going to completely say that analog isn't

20   supporting safety.   I think analog, as it operates, is a sufficient product.

21   Digital is just as sufficient but it also brings the ability to

22   add multiple layers of safety protection into your system whereas in analog

23   you can't necessarily have dual redundancy or triplication, et cetera.

24   So you can design -

25   COMMISSIONER CAPUTO: So   would   offer   some

26   defense in depth?

1   MR. SCOTT: Yes. So you can offer a lot more defense

2   in depth for the digital system versus an analog system.

3   The biggest issue, I think, is that digital offers a lot of

4   benefits that can improve the operation of the plant to keep it more stable.

5   But the biggest challenge with analog is it's a component issue of being able

6   to get at the supply chain.   That's the challenge.

7   I mean, when we look at getting components you've got

8   two parts - A, finding the component is a challenge. The second part is

9   finding engineers that understand how to do critical characteristics of the

10   component that you find when you want to go and upgrade your analog

11   system.

12   We support an analog system.   We have been supporting

13   it for 40 years, and we are getting to the point now where it's very difficult for

14   us to find components with that product - you know, transistor material that's

15   even fabricated - and then when we go to make a change on those particular

16   cards finding people that understand how to do those characteristic analysis

17   is a challenge.

18   So it's a sustainability issue as well as yes, it's a

19   performance and you can do defense in depth and et cetera. But, really,

20   there is a sustainability issue around analog versus digital.

21   COMMISSIONER CAPUTO: Well, that's a natural segue

22   to my next question.

23   Mr. Pitesa, I believe you stated in discussing how

24   important digital instrumentation and control is to the long term viability of

25   plants.

26   I believe, if I heard you right, you used the term imperative

1   and particularly for subsequent license renewal and the long-term viability of

2   our nation's nuclear plants.

3   Could you please discuss that in a little bit more detail?

4   MR. PITESA: Certainly.   I mean, when I think about

5   plants that are going to be operating in the 2050s, the 2060s, the people that

6   are going to be running that plant aren't even born today, and to say I am

7   going to bring them in and teach them analog technology is just so foreign

8   to, I think, the realities of the future.

9   We have to migrate to a technology that they are going to

10   learn through their educational system, that they are going to learn and be

11   able to operate these plants in a way that supports their knowledge base

12   coming to the program.

13   COMMISSIONER CAPUTO: Okay.

14   Mr. Scott, back to you.   You stated in your slides that what

15   is missing in digital I&C is trust in technology and you make the point that

16   technology platforms have billions of hours of operation without failure.

17   What is your view about how we can take that information

18   and incorporate it into a risk-informed approach?

19   MR. SCOTT: You know, I think - I think EPRI's doing

20   some efforts towards that and I think other groups have looked at that.

21   You know, it's an interesting question because we have

22   had this debate from as long as I can remember.   I mean, it's been many,

23   many years that we keep looking at it.

24   So we have looked at other industries.   I remember sitting

25   on some of the original committees with the NRC looking at other industries

26   and saying well, you know, FAA has been doing this or gas - oil and gas has

1   been doing it - why don't we take credit for it.

2   And there just seems to be a nervousness to truly embrace

3   what's out there, and when you look around, I mean, everything today is

4   digital regardless of what you're more or less involved in.

5   And in all of those other industries, all of those other critical

6   operations - and there is a lot of critical operations that are far more

7   impactful than a nuclear plant, in some respects -that have been reliant on

8   digital technology for years.

9   And I just think we need to understand and accept the fact

10   that technology is not the challenge.   I think John has stated it very well that

11   how we understand what needs to be designed to go into the system is

12   critical and I think that's the important focus is that we need to understand

13   what the functional requirements are, how we interpret those, how we

14   implement them.

15   The technology is going to work.   Software works.   I

16   mean, hardware works.   I mean, there are some failures on hardware side.

17   But when you look at how much technology is out there, it's really a robust

18   solution.

19   And I just think we are not giving it the credit that it needs.

20   COMMISSIONER CAPUTO: So I am going to back up a

21   little bit.   My fundamental understanding at this point, which is very

22   fundamental, was that the industry was making some low safety significant

23   upgrades in 2012.

24   Those   efforts   stopped.   There   have   been   some

25   subsequent efforts on license amendments but not many.   Mr. Pitesa talked

26   about regulatory uncertainty.

1   So I guess to Mr. Pitesa and Mr. Novak -Mr. Novak, you

2   made a statement about how significant positive impacts can be achieved

3   without waiting for rulemaking.

4   Can you talk about how you think we should do that?   And

5   Mr. Pitesa, your ideas on how you think we should do that in order to work at

6   reducing the regulatory uncertainty?

7   MR. NOVAK: I think what they are doing with the revision

8   to ISG-06 is going to go a long way in this direction of making a very positive

9   difference.

10   You know, I meant - we talked earlier about how a project

11   needs to basically be complete and then the review of the software

12   development process that had been used all along kicks in and that just

13   takes time.

14   What the ISG-06 revision is doing is it's - the NRC would

15   review and approve the overall process for developing a software but the

16   review of the actual product is they are going to rely on a combination of the

17   licensee's vendor oversight and also NRC inspections.

18   And the details are still to be worked out, but I think that

19   would help a lot to eliminate and to make a lot of positive impact with our

20   rulemaking.

21   COMMISSIONER CAPUTO: Okay.

22   MR. PITESA: And I agree completely.

23   The RIS for low safety significant systems and ISG-06 for

24   more safety significant systems, quite frankly, you're looking at an industry

25   that's just been kind of held back for so long.

26   We are trying to really understand what's going to be the

1   opportunity out of those changes, and it goes back to Mr. Baran's question.

2   Mr. Baran's question is until we fully internalize how much

3   relief we have been given on the ability to implement digital in low safety

4   significant and high safety significant systems, which will require better

5   understanding of what ISG-06 ultimately is I think then we will be able to

6   weigh better on what is next and what more do we need to go forward from

7   here.

8   COMMISSIONER CAPUTO: Okay. Because I guess - I

9   guess when I look at it and I think we have been at this for 30 years we are

10   still in the domain of RIS and interim staff guidance - multiple versions of

11   interim staff guidance.   We are revising action plans.

12   I guess I am kind of struggling with how much are we

13   continuing to revise how we are going to do this but not actually getting to

14   the point where we actually do it and that's the path forward that I am looking

15   for here.

16   Thank you.

17   CHAIRMAN   SVINICKI: Thank   you,   Commissioner

18   Caputo.

19   Next we will hear from Commissioner Wright.

20   Please proceed.

21   COMMISSIONER WRIGHT: Good morning, and I am

22   going to join my colleagues in thanking you for your presentation this

23   morning.

24   And Dr. Thomas, whatever you had for breakfast -

25   [Laughter.]

26   MALE   PARTICIPANT: I   want   the   address   of   his

1   Starbucks.

2   COMMISSIONER WRIGHT: You're one passionate guy

3   and I appreciate what you bring to the table today.

4   So like Commissioner Caputo, I am new and many of the

5   questions that have been circled around this table for the last three decades

6   have been probably asked multiple times.

7   So I am probably going to go a little different direction,

8   being new, and anybody can answer this question, you know, that I am

9   going to pose.

10   But I am going to pose it to Bill. You talked about the

11   need to modernize, you know, to the regulatory framework and you talked

12   about the transformation team's recommendations in that area.

13   But the mission of the NRC is, you know, the reasonable

14   assurance of adequate safety. Do you think that this whole digital I&C

15   process has been following that path or has it been more toward a zero risk

16   initiative?

17   And I'd like to hear your comments about that.

18   MR. PITESA: I feel like there has been a desire to create

19   absolute certainty and zero risk because I think people have been afraid of

20   the ghost in the machine that they just don't know about.

21   So we just need to look at everything to ensure there are

22   not ghosts in that machine, and I think what we have seen in the

23   advancement of digital in other fields of industry proves that you don't have

24   to search every single line of code looking for that ghost in the machine.

25   You can achieve reasonable assurance by following - I still

26   go back to the example the FAA used that says you're following processes

1   that I endorse and when I do check in limited ways that check confirms that

2   you're doing that appropriately.   And I think that would be a great movement

3   for our industry to consider.

4   COMMISSIONER WRIGHT: Yeah.

5   Scott.

6   MR. SCOTT: I would agree.   I think it's a - we are trying

7   to what-if it to a perfect ideology, which is not going to - it's not going to get

8   us there and I think that's where we are stuck is we are just trying to get it to

9   a zero position.

10   MR. ROMANSKI: So the industry in the aviation side

11   pushed differently.   What the big guys - people like Boeing - what they said

12   is that we need a mechanism to know when to stop - when to stop testing.

13   Airplane crashes - everybody's going to sue us.   If we say

14   we have tested it, they say, well, clearly, you didn't test it enough, if the

15   accident was caused by a software failure.

16   So they said we need a stopping criteria.   So we put that

17   into the regulations and we said, well, if you do a requirement-based test

18   and you measure how much code you've covered and if you've covered the

19   code then you're done.   You don't have to do anymore.

20   And we have different measures of coverage, depending

21   on the criticality or design assurance level.   But it was really driven by

22   industry knowing that they need a mechanism by which they can stop.

23   Is it perfect?   It's not.   Errors can still get through.   But at

24   least we have a stopping criteria, which is - which gives you a good measure

25   that you've done enough.

26   COMMISSIONER WRIGHT: I believe you used the word

1   faith - a leap of faith.   Was that you or - one of you used it.

2   [Laughter.]

3   MR. PITESA: But I think - I mean, I think there is an

4   aspect of trying to discern what the difference is between perfect zero or

5   perfect assurance versus reasonable assurance.

6   COMMISSIONER WRIGHT: Correct.

7   MR. PITESA: And I think that's been a huge challenge for

8   our industry and that is the path forward that we have got to achieve is how

9   do we just dissect those in a way that this is what reasonable assurance

10   truly looks like in digital.

11   COMMISSIONER WRIGHT: Do you - do you see the

12   transition   team's   recommendation   moving   more   toward   reasonable

13   assurance or do you have a comment or is it still the same?

14   MR. SCOTT: I think we are moving more towards that

15   direction.   I just don't know if it's aggressive enough to get there.

16   COMMISSIONER WRIGHT: Okay, another question here

17   and this is going to go towards standardization.   I was at Naval reactors a

18   few weeks ago and I watched the -- I was really intrigued the way they did

19   things.

20   The Navy is a benevolent dictator so they own a little bit

21   more of the process and the vendors and all, but I saw the way they

22   leverage standardization and what they do and you mentioned the aviation

23   industry a while ago.

24   Has the industry looked at ways to maybe standardize

25   digital I&C across -- you've got a lot of different types of plants and all that

26   kind of stuff.   But have you looked at that?

1   Because one of the things, everything is one off, that's the

2   most expensive way to do things.

3   MR. PITESA: You're exactly right.   And I look at

4   TELEPERM, it was a proven technology that Oconee brought from Areva at

5   the time, and it had been used internationally.

6   It was kind of a standard technology, we had to turn

7   around to apply it through IEEE standards and everything else, customize it

8   to the point where it's a complete one-off now.   So I think standardization of

9   the rules will create standardization of the products.

10   MR. SCOTT: We've tried to take commercial off-the-shelf

11   technologies the best that we can, trying to choose the most robust COTS

12   products so we can bring them into the industry.

13   And I think that's a view that a lot of utilities are looking for,

14   to find a supplier that can provide a COTS product that's sector-wide so it's

15   not a one-off.

16   The challenge is, obviously, it's difficult for suppliers to all

17   have a common-type goal because they're all competitive in nature in certain

18   ways but I think to Bill's point, the more common and the more standardized

19   we are globally, then there's a basis for us from a financial perspective to

20   say, okay, well, it makes sense to make a platform that satisfies a lot of

21   different regions.

22   Because right now, we're in situations where different

23   regulatory bodies drive different requirements so you have to look at certain

24   markets and saying, well, okay, if I'm only going to satisfy two or three plants

25   in that regulatory regime then does it make sense for me as a business to

26   focus on that?

1   So then you step back and you make decisions driven on

2   that.   So I really think harmonization of the standards really helps the supply

3   chain levelize that a little bit.

4   COMMISSIONER WRIGHT: Do you have any comment

5   about that?

6   And I guess, really, you talked about the IEEE and IEC

7   standards and I'm trying to harmonize that stuff too.   What are the biggest

8   challenges the you see going forward in trying to do that?

9   MR. NOVAK: What's the biggest challenge with changing

10   over to something else?

11   COMMISSIONER WRIGHT: Yes, what would be the

12   biggest?

13   MR. NOVAK: We'll have to start with the rulemaking and

14   the writing guidance on how to and with the endorsement of all of the

15   subordinate standards because it's going to be a time-consuming process.

16   COMMISSIONER WRIGHT: So one of the things that

17   concerns me just in the five months I've been here is that it seems like

18   sometimes maybe we're standing in our own way and standing in the way of

19   some real beneficiary safety improvements that would takeaway human

20   error factors as well.

21   And I see this as possibly being one of those, it seems to

22   be what I heard George talking about and you too, Doctor.   I'm just trying to

23   find a way to get it done cleaner, better, more efficient, and keep in our

24   mission.

25   DR. THOMAS: I've got a comment along those lines.

26   I've heard standards mentioned a number of times.   I'm on standard

1   committees for aviation and automotive and other industries and I've seen

2   the sausage-making.

3   And standards are good but they're not perfect and we've

4   got to be a little careful here. The answer to this problem is not to copy a

5   standard that exists.

6   My biggest fear, what keeps me up at night, is there are

7   some standards that are very good for this problem and there are a lot of

8   standards that, frankly, are not very good. The standards are not created

9   through a nice, scientific process.

10   They haven't even been tested. They're created by a

11   bunch of experts that sit at a table like this and say what should we write

12   down?

13   And that's why we have different standards even within the

14   same industry that conflict with each other and things like that, right? So

15   don't just copy a standard because it exists. That should not be our criteria.

16   The criteria is actually very simple, it's a little revolutionary, but it's very

17   simple.

18   We need to test, we need to do a proper test, not taking

19   something in hindsight and seeing if it will stuff in a box and not proving by

20   theory that it can fit. Do a proper test with real engineers, try it out.

21   Some of these tests have been done, some of these have

22   not. Whatever standard you're looking at I suggest that we should put

23   somewhere in here a gateway that says let's define a proper test and make

24   sure it's really going to work for our problem, and then your decision is easy.

25

26   You have the evidence you need, we're trying to make a

1   decision without the evidence and that's the problem. Let's make sure we

2   collect the right evidence and the decision will be easy I think.

3   COMMISSIONER WRIGHT: Thank you, thank you very much.

4   MR. SCOTT: I guess an interesting thing that might be

5   thought about is supply chain has done a lot of significant digital

6   modifications, either new plants or modernizations around the world.

7   There's a lot of history, there's a lot of data, there's a lot of already tested,

8   proven, documented basis.

9   But if that were to be submitted, for example, let's say a

10   utility wants to do an upgrade of the United States and they bring in a

11   supplier that's done similar-type upgrades in four or five different other

12   countries or plants and submit that along as a base of support and get credit

13   for that, we've got to look at different ways.

14   Because I do think we're losing a lot of value in what's

15   been done in other similar environments.

16   COMMISSIONER WRIGHT: Thank you very much.

17   MR. ROMANSKI: The approach that the FAA has taken

18   is that we have started a number of projects where we are partnering with

19   the Applicants.   So this is new technology, new techniques that people are

20   proposing, and they come to the FAA and have said, well, would you accept

21   this?

22   And we said we don't know, however, let's have a project

23   where you put your people on board, we'll put our people on board and we

24   will work the problems together so that we learn from them and they learn

25   from us and they get early approval.

26   So we have a number of these partnership programs,

1   especially in the new technologies like the unmanned air systems.

2   Thank you.

3   CHAIRMAN SVINICKI: Well, thank you all again for your

4   presentations.

5   As someone who has been watching the NRC activities in

6   this area for over ten years now, some of what I've heard in your

7   presentations and response that you gave to the questions of my colleagues

8   added validation in some instances to a series of observations that I've been

9   adding to over the years.   And maybe I'll share some of that and if

10   time remains, offer the opportunity for any of the panelists to take exception

11   to anything I've said or to add some additional thoughts about it.

12   Let me just say that I think the first meeting that I attended

13   on digital I&C as a Member of the Commission, I haven't looked this up but I

14   was thinking about it as I sat here, it might have been 2008.

15   And two regulated companies were on the external panel

16   because they were representing two attempts at adoption of digital I&C

17   projects at plants.

18   One was Wolf Creek and it wasn't a terribly ambitious

19   project so they were considered the applicant who had a limited complexity

20   to what they were trying to do. The other might have been Oconee but I'm

21   really not sure so I don't want to say that I don't think Bill was at the table.

22   But I asked the two representatives of companies that had

23   engaged the NRC, again this was ten years ago, some sort of limited

24   non-safety-related project, and one of the presenters said that he felt as if he

25   were attempting to swim the English Channel and that he got to a point

26   where he regretted that his company had ever, ever decided to engage the

1   NRC in this process.

2   But he knew that he had to proceed because he drowned

3   and didn't have the energy to go backwards.   And so I'm sure no Member of

4   the Commission ever wants to hear someone describe their engagement

5   with the NRC in such stark and life and death terms, but as I've watched this

6   evolve, I think some of the challenge is that -- well, first of all, let me talk

7   about something which is publicly known which is that NRC experts are not

8   of one set of philosophies on this.

9   I don't say that to reveal our dirty laundry but I think it is

10   well-known that in the new reactor area, there has for whatever reason been

11   a greater ease around fully digital systems that is not evidenced in other

12   groups of the Agency's experts who are working more with the current

13   technology.

14   So that does leave one with a conclusion that there is a

15   certain kind of mindset or paradigm that the various experts may be bringing

16   to the issue that cause, in some cases, there to be a regulatory exceptions

17   of something than in other cases.

18   And so I tried to think about why that is and I wonder if in

19   some instances we are expecting digital systems to make a demonstration of

20   providing safety in the same way that analog systems, the same way that we

21   would assess their ability to do it.

22   And until you come to some sort of acceptance that digital

23   systems will not provide a basis for a safety conclusion with the same means

24   and methods that analog systems do, then you are trying to force-fit digital

25   systems into providing you with an assurance in the same way that analog

26   does.

1   And they fundamentally perform differently, they are just

2   different at birth and at origin and the notion that you can force-fit one into

3   giving you the same confidence and safety demonstration in the exact same

4   way.

5   I think the notion that one is more safe than the other, I

6   think that whole question, you've kind of failed at the starting gate because

7   that's very, very difficult to say if I allow digital systems on safety-related

8   things at nuclear power-plants, have I diminished safety? Have I

9   relinquished some sort of safety?

10   And I think that's the really the wrong way to look at it.

11   Engineers for some years now have been required to take the rudiments of

12   some sort of programming, this was true even in the antiquated days when I

13   was in engineering school.   And that was always the most difficult thing.

14   But the lines of code will do -- I mean, it's math and it's just

15   a functionality but the problem was if you didn't understand the system, that

16   is always why the rudimentary programming that I would have had to do in

17   engineering school, it was that I failed to understand the problem because

18   the code does what the code does.

19   And I think that any of us that went through that humble

20   experience -- so I think another challenge has been what we need to do is

21   weigh the benefits of how digital provides safety assurances against any

22   complexities that it might pose, any uncertainties that it might pose.

23   And if we don't look at the nuclear power-plant as an

24   integrated system that has these digital systems, it's very difficult to weigh

25   the benefits of what digital brings against the risk that it brings if you're not

26   looking at a fully integrated system.

1   And there's been some discussion of systems engineering

2   here today and I think that, again, if we neck down and get a narrow focus

3   just on digital being like analog, then I think we're not going to adequately

4   understand the massive redundancies that digital can offer in the defense

5   in-depth.

6   I think that term was used and that's a term we use here

7   but I think it can provide enhancements.   So I view that in the ten years I've

8   been watching this issue, we have definitely foregone benefits that digital

9   could have been providing in that timeframe.

10   I do agree that the Agency coming to some greater ease

11   and structure around this is an imperative, that term was mentioned as well.

12   This is not an optional thing.   I've been asked by people who do only

13   cybersecurity, can't you just force nuclear power-plants to continue to have

14   analog?

15   And I said we could require that but I think as a result, the

16   nation will forego nuclear power because they don't believe that it's

17   sustainable.   So we've also talked a lot about codes and standards and I

18   want to take the counterpoint, I'm not going to malign codes and standards.

19   By the way, as a Government Agency, we're required

20   under law to refer to and adopt standard industry codes and standards and

21   not develop our own ad hoc ones, again, because that's just viewed as

22   something that enables commerce and makes a lot of sense because we

23   shouldn't sit back and have our own.   We can endorse them, we can cite to

24   them, and I understand that, but we're constructing two nuclear power-plants

25   in this country down in Georgia right now and the American Concrete

26   institute has codes and standards.

1   So this is concrete so let's stipulate that's not as

2   complicated as digital systems and software.   We were engaged in

3   protracted, interpretive engagement with the constructors as to whether or

4   not what they were doing in the field complied with the ACI standards.

5   So I think the notion that codes and standards can solve

6   this is true.   But people get to interpret whether or not what is happening

7   meets the code or the standard and so let's not forget that has been a very

8   important part of this dialog.

9   We can take IEEE 603 but then NRC has to agree that

10 what we think meeting that standard looks like is the same thing that the

11 vendor thinks, is the same thing that the operator thinks.

12   One last thing that I'll mention that I had not thought about

13 but based on our colleague from the FAA, it was very interesting to hear him

14 talk about what he called an incremental review or engagement on the

15 development of this system.

16   And I believe that you even commented that you found it

17 somewhat astonishing that you could take a fully completed digital system,

18 take that design and review it post-hoc after it's already been completed.

19   The NRC has been engaged a lot in the advanced reactor realm

20 about taking the regulatory framework we have now, which is

21 performance-based and I'm going to conclude by making some comments.

22   We've hear a lot about risk-informed, the other thing we're

23 supposed to be is performance-based and I think that's another element that

24 we need to get clarity of thinking about when it comes to digital adoption and

25 nuclear power-plants.

26   But with the advanced reactor community, we've come to

1   understand that they don't want to invest the money to have a fully

2   completed design before some of the very different concepts that they're

3   thinking about for various aspects of the design, before they know that those

4   things have any snowball's chance in you know what of getting approval by

5   the regulator.   So what we have done is we've said we're not changing

6   what you have to demonstrate to get your design approved but we're going

7   to have a regulatory engagement plan with you that will set up an advance,

8   you will tell us how you want to evolve and finalize aspects of what you're

9   talking about, we will agree to have touch-points along the way as you're

10   developing it, and we can't give you approval per se but we can give you

11   something that is a very valuable reaction. If you were indifferent on the

12   alloy you were choosing for a component and I said this one we know really

13   well, if you could pick this alloy we wouldn't have to engage in a lot of testing

14   and other things, and they might say I'm indifferent on that, that's great,

15   that's very helpful to know that upfront.

16   Maybe we would benefit from having the Staff think about it

17   and make a decision, but having the Staff think about is there something

18   akin to the regulatory engagement plan development that we've been having

19   with advanced reactor vendors, none of whom have come in for review yet,

20   would that benefit? Would the designers of digital I&C systems, would a

21   parallel system be helpful? They could have an understanding upfront, a

22   kind of compact if you will, to say I'm going to come in and get regulatory

23   reactions, if not approvals to things at various steps along the way.

24   Maybe we need to learn more about what the FAA has

25   done there and see if that's something that we should have been doing all

26   along for very complex digital upgrades or systems.

1   Because we've approved whole platforms, which has not

2   been discussed today, but we've got some advanced reactor digital I&C

3   platforms that we've approved. And let me conclude with

4   performance-based because I think that's the other element here.

5   We've talked about a rulemaking versus continued

6   progress on the guidance documents. I'm not certain that I want to yield

7   today to the notion that it has to be either/or and that may have been some

8   of what the staff was talking about in the transformation paper.

9   Maybe a separate transformation activity that would look at

10   -- the rulemaking is supposed to be about what do you need to

11   demonstrate?

12   The guidance is about possible versions of what that could

13   look like and so I think the other thing we struggle with in digital I&C, at some

14   point we do need an enduring place where we have enshrined the

15   paradigms and the prisms through which we are viewing the showing or

16   demonstration that is required for a digital I&C system that we assess meets

17   reasonable assurance of adequate protection, as my colleague mentioned.

18   I think at some point you do need to have a

19   performance-based articulation of that in a regulation and that would give

20   enduring flexibility. Because we've talked a lot about the NRC Staff having

21   adequate flexibility and looking at digital I&C systems.

22   The other thing that people want out of a regulatory

23   framework is predictability and if it's too flexible and too ad hoc in saying,

24   well, just bring a system that's fully designed and after you're done designing

25   it, I'll tell you if it meets reasonable assurance of adequate protection and I

26   can't articulate for you upfront what that demonstration or showing is going

1   to require, then I think we end up with these extremely protracted review

2   schedules and we add complexity because we haven't defined upfront

3   exactly what are you required to convince me of?

4   And if knew what that was and I knew how digital systems

5   did it and I didn't make them try to show me that and give me that same

6   confidence in that exact way that the analog systems did, but I leaned into

7   the uniquenesses and benefit of digital systems.   So that's my overall sense

8   of what we're struggling with.   I don't know the best methods for us to get

9   there.   I think Congress has asked NRC to go look at the military, to look at

10   aviation, to look at medical I think was in there as well.

11   We haven't talked about that today, we're all putting our

12   lives on the line with a lot of medical technologies that are extremely

13   dependent on digital systems, but I think they've asked us to look at the

14   philosophical approaches there because digital I&C is so much more

15   absorbed into those areas of commerce and to say why is it that those

16   approaches that have provided acceptability to regulators in those sectors,

17   why is it that they don't work for nuclear.

18   So I think we have a report due to Congress on that but I

19   think that might be interested as well.   But again, I've gone over but I

20   appreciate your time here today and I'm of a mind, I haven't made any

21   decision until after the Staff panel goes but I'm of a mind that maybe the

22   Commission should set another meeting in X number of months.

23   I might propose that to my colleagues that in this meeting,

24   the direction on this meeting, we say that we should have another of these

25   meetings.   Because maybe it needs a more consistent attention from the

26   Commission.   It's been getting episodic attention but not consistent

1   attention.

2   So I've run over so I would ask if my colleagues have any

3   just brief additional thoughts or anything they would like to share.   With that,

4   I think we will take a very modest break of five minutes while we reset the

5   table for the staff panel.

6   So that would take us to 10:55 a.m.   Sometimes the

7   clocks in here are wrong so let me see.   Yes, 10:55 a.m. or perhaps even a

8   little bit longer.   But thank you all again for your presentations and we'll

9   recess.

10   (Whereupon, the above-entitled matter went off the record

11   at 10:50 a.m. and resumed at 11:00 a.m.)

12   CHAIRMAN SVINICKI: I call the meeting back to order.

13   If everyone will please take their seats for our second

14   panel, we will now hear from the NRC Staff on digital I&C activities

15   underway, in progress, and probably a little bit of the history of how they got

16   to where they are today.

17   And to lead of the Staff presentation, I will turn to the

18   Executive Director for operations, Margie Doane.

19   Margie?

20   MS. DOANE: Okay, good morning, Chairman and

21   Commissioners.   That was a lively discussion that you had with the last

22   panel and we're looking forward to giving you our presentation on digital

23   instrumentation and controls or digital I&C.

24   I too have been sitting at this table for a long time, I sat in

25   that seat for six years and saw a Commission Meeting on digital I&C and I've

26   also heard through numerous other Commission Meetings how this topic is

1   vexing for us.

2   It's been complicated, so I share your perspective, and so

3   does the Staff.   What I can tell you that's different today and I'm comfortable

4   saying that from my observation I see progress, but what I can tell us

5   different today is that I believe that we're working with these various

6   communities to set goals, we're putting a reasonable milestone schedule in

7   place and we're meeting those milestones that we have set.

8   And we're striving, we've told ourselves we're striving, to

9   make sure that we're not an unnecessary impediment to safety

10   improvements. And we have heard the same thing you heard on the last

11   panel, that there are real benefits to this technology and that we need to

12   make progress and we need to move this forward.

13   I believe that what spearheaded our more recent progress

14   is the direction that the Commission gave us in SRM-15-0106 where it

15   motivated us to come up with an integrated action plan and that's where

16   we've actually set out these milestone schedules and we can work with the

17   community, various communities, to come up with this schedule.

18   And so I think that provided a framework that has

19   precipitated this progress. Let me step back a second. Commissioner

20   Caputo I think has touched on this and so did other Commissioners that

21   progress is relative to the journey and I get that.

22   It's relative to the journey. If you're going 3000 miles and

23   you've made progress and you've gone 1500 miles, it's halfway but you still

24   have a long journey, a lot of time and effort to go. If you have a short

25   journey, ten miles, and you've gone halfway you're almost there.

26   So when people say we've made progress, I understand

1   what you're saying. You've made progress but where is it relative to the

2   goal line?   And we're hearing you.

3   And I think we've identified the key issues and I think we

4   have a very good engagement schedule that I am confident that we are

5   going to continue to make progress.

6   And as you heard also on the other panel, there are three

7   distinct communities that are giving us a lot of feedback.   It's operating

8   reactors, advanced reactors, and also the vendor community that's providing

9   the digital equipment.

10   And they're all coming at it different directions and so we

11   are engaging in numerous public meetings and have put a lot of resources

12   into understanding those issues to move forward.

13   And so along this milestone schedule, one of the final

14   milestones is to look at -- so we're making improvements in our regulatory

15   approach and we look at those improvements and I look forward to a lot of

16   discussion.

17   I expect we'll have some similar questions about the old

18   system or the old regulatory approach versus a brand-new regulatory

19   approach but what I'd like to say is that we can definitely make innovative

20   changes with the old regulatory approach.

21   But what that final milestone talks about is real

22   transformative changes, things that would cause you to do the process in a

23   completely different way.   And like the Chairman was saying, when you

24   talked about putting principles in place that were kind of nailed down, a

25   rethinking.

26   Now, when you should do that and all that, obviously

1   you're going to hear from us and I'm sure we'll have a good discussion about

2   that but I just want to talk about innovation versus transformation in that

3   regard.

4   As you know, the Staff proposed their transformation in

5   this topic.   We propose that in the paper in SECY 18-0060 achieving

6   mod-and-risk-informed regulation, which we call the transformation paper

7   and I don't want there to be any misimpression that, or I want to emphasize

8   that we're continuing to do a lot of effort that would lead us to being able to

9   work toward that final milestone which would be maybe perhaps a

10   completely different regulatory schedule.

11   We're doing things now that will actually help us to

12   advance progress on doing a rulemaking because some of that work is

13   being fed into these innovative approaches to even using the existing

14   regulatory approach.

15   So while it will be very important to hear the Commission's

16   views on that transformation paper, it's not slowing our progress in any way

17   because we have so many things to do right now and also as we think of

18   innovating the process going forward.

19   So, with those introductory remarks, I'd like to now, next

20   slide, please, I want to give you a brief introduction of who we have at the

21   table and what topic they're going to present.

22   So, by now you all know Ho Nieh, the Director of Office of

23   NRR.   Ho will be discussing the priority the NRC has placed on making

24   progress on digital I&C issues so that potential safety benefits can be

25   realized by properly implementing digital I&C upgrades.

26   And   Eric   Benner,   Director   of   NRR's   Division   of

1   engineering, and you'll hear this referred to as DE throughout the

2   presentation, will discuss the staff's detailed priorities, their incorporation into

3   the integrated action plan or the IEP that I was referring to earlier, and the

4   factors that have enabled our recent successes.

5   Rossnyev Alvarado, an electronics engineer in the Division

6   of Engineering will discuss issues surrounding common cause failures of

7   digital I&C systems.   Let me take a break here for a second.

8   I just want to let you know that Mr. Pitesa on the previous

9   panel from NEI mentioned that I would discuss one of the topics that he had

10   referred to in SECY 18-0090 that had to do with common cause failure and it

11   really had to do with the issue of how that paper took into consideration

12   risk-informed approaches.

13   And I think the paper did not speak to that directly and so

14   Ms. Alvarado will be able to put more specifics on that matter.

15   Mike Waters, Chief of DE's instrumentation and controls

16   branch will discuss our progress, especially over the last year, in working

17   with the industry and public settings with the goal to provide clarity to the

18   digital I&C regulatory infrastructure.   And Dinesh Taneja, a senior

19   electronics engineer in DE will discuss commercial grade dedication issues

20   and the longer-term modernization of the NRC's digital I&C regulatory

21   framework.

22   So, again, we appreciate the opportunity to discuss these

23   important issues and now I'd like to hand the presentation over to Ho.

24   MR. NIEH: Thank you very much, Margie.   Good

25   morning, Chairman, good morning Commissioners. I'm very happy to be

26   here this morning. I might not be as happy as Dr. John Thomas from MIT

1   but I'm pretty darn happy to be here.

2   I'm really glad to be here with my colleagues to talk to you

3   about the actions we've taken in enabling the broader use of digital

4   technologies at our nation's nuclear power-plants.

5   As you know, this is my second month on the job and I'm

6   fortunate enough to have a second opportunity to be here before you at this

7   table.   I suppose I'm lucky in that regard.

8   I mentioned in September last month at the business line

9   meeting that I've been drinking from this fire hose.   I kind of still am but the

10   diameter of the hose is a bit smaller so that's really a good thing.

11   So, after being back for about two months, I've really had

12   to quickly come up to speed on this topical area and had to go back and look

13   at the record and look at information coming from the staff.

14   And I have to say, on the one hand, it feels kind of strange

15   to sit here and talk to you about enabling digital, especially in this age where

16   digital technologies are ubiquitous in many industrial applications as well as

17   our everyday lives.

18   And we all know that the digital revolution started many

19   decades ago so it is quite strange to have this conversation.   But on the

20   other hand, I also think that I have a much better appreciation of the

21   challenges we faced just to get to where we are today.

22   And again, after speaking with the Staff and reviewing their

23   record, it's evident to me that since the beginning of this year, we did make

24   some progress in enabling the use of digital.

25   For example, we clarified the guidance and the risk on the

26   use of 50.59 for digital upgrades, we went out proactively and did workshops

1   with industry and our regional staff to better increase the understanding of

2   how to apply the guidance and doing upgrades under 50.59.

3   And it's my understanding now that many of our licensees

4   are using that guidance to make modifications today, using digital systems in

5   their plants.   So to me, I think that's a very positive sign of moving progress

6   in this area.

7   In my previous position at the Nuclear Energy Agency

8   working internationally, I had the opportunity to see how digital systems can

9   be used in both safety-related and non-safety-related applications in nuclear

10   power-plants around the world.   I also had the opportunity to engage with

11   many of our international regulatory counterparts to better understand how

12   they address some of the challenges that we'll be talking about to you today.

13   And for sure, common cause failure was a main concern

14   for many of the regulatory bodies and through testing, operating experience,

15   and flexible regulatory approaches, we do see that digital systems are used

16   in nuclear plants and other safety-critical industries around the world today.

17   In listening to the conversation in the industry external

18   panel, I think operating experience is one area that I'd like to further explore

19   with our staff on how we're better incorporating lessons from other industries

20   and other countries into how we're conducting our regulatory reviews.

21   Another takeaway that I had from the international

22   experience was that among many of the nuclear regulators abroad, there's a

23   very positive attitude towards enabling innovative and new technologies in

24   nuclear power-plants, and in fact, there's a growing recognition that new

25   technologies like digital systems can improve plant performance, reliability,

26   and also safety.

1   And I think that's particularly relevant if we're looking at

2   nuclear power-plants operating in the longer term, particularly as older

3   equipment and analog systems become harder to find in the supply chain

4   and become more and more obsolete.

5   So turning back to looking at NRC, what I found really

6   interesting was that we have been able to, as you mentioned, Chairman, to

7   make regulatory reviews and decisions for major digital platforms and new

8   reactors like the AP1000, APR1400.

9   We even took an adaptive approach and used a

10 design-specific review standard to look at the digital platform for the NuScale

11 small modular reactor.

12   And in exploring my curiosity about this asymmetry in how

13 we look at digital I&C for new reactors versus operating reactors which, oh,

14 by the way, we're using the same requirements and regulatory guidance, I

15 reached two conclusions.

16   The first was that we have the technical capability and

17 expertise to do these reviews successfully and timely. We can do this and

18 we've shown that we can.

19   And the second conclusion I reached was that with a shift

20 in our mindset and our culture towards innovation and new technologies, I

21 think we can greatly make even more progress on broadening the use of

22 digital systems in nuclear power-plants.

23   As you know, the courses have been set for the merger of

24 NRR and NRO and 2020. In fact, this month we've already made some

25 pre-merger consolidate efforts.

26   We took the digital I&C functions from both offices and

1   combined them into one under NRR and the vision for how we're going to

2   look at these reviews of new technologies including digital systems is a

3   vision where we're going to ask ourselves the questions, how can we do this

4   while ensuring safety, rather than why we shouldn't do this?

5   I think that's a real important aspect of this transformation.

6   So, in looking at the journey we've been on with digital I&C, now against the

7   backdrop against the Agency's efforts to transform itself, I really think we

8   have a real opportunity here.

9   The story we want to leave with you today is that we're on

10   a positive trend and I think the more things we can do to be more

11   risk-informed, if we receive direction from the Commission on having more

12   performance-based framework and focusing our efforts on reasonable

13   assurance, I think that's going to help us continue on this positive trend of

14   progress.

15   So with that, Chairman and Commissioner, I'd like to

16   conclude my remarks and turn it over to Eric Benner who will talk to you

17   about the progress we've made on the integrated action plan.

18   Thank you.

19   MR. BENNER: Thank you, Ho. Slide 4, please.

20   Morning, Chairman and Commissioners.

21   The Staff continues to be focused on addressing the most

22   significant regulatory challenges that we've identified through our

23   stakeholder engagement, including engagement with our international

24   counterparts and other domestic regulatory Agencies.

25   Those challenges fall into two broad categories. The first

26   is near-term issues that our stakeholders have identified as impediments to

1   implementing digital technologies today and the second is broader

2   modernization improvements that can longer-term make our review efforts

3   more effective, agile, and performance-based for all technologies.

4   So, my slide has some of these particular items, I'm not

5   going to go through the list because Rossnyev, Mike, and Dinesh are going

6   to discuss each of them in more detail.

7   Next slide, please.

8   So, Margie referenced the IEPs, let me provide a brief

9   background. In the SRM to SECY 15-0106, the Commission directed the

10   Staff to develop an integrated strategy to modernize the NRC's digital I&C

11   regulatory infrastructure.

12   The SRM indicated that requirements in this area should

13   be performance-based and technology-neutral and apply to both operating

14   and new reactors but acknowledge that guidance could be tailored to the

15   different communities.

16   The SRM also directed us to hold frequent stakeholder

17   interactions to reach a common understanding of regulatory challenges,

18   priorities, and potential solutions to address them.

19   The Staff developed the IEP to fulfil this direction, which

20   was provided to the Commission in May of 2016 and the Commission

21   approved in October of that year. The Staff periodically updates the IEP to

22   reflect our progress and evolving priorities.

23   Given our recent accomplishments, we're currently

24   finalizing a more extensive re-baselining of the IEP developed with

25   significant input from our stakeholders which we will provide to you next

26   month and which provides more detail to the activities described in SECY

1   18-0100.

2   Next slide, please.   We've had some recent significant

3   successes which you'll hear about in more detail, but I'd like to set the stage

4   for the mindset changes that enabled those successes and put us on a path

5   to continued success.

6   This gets back to some of what we feel is different today.

7   First, we committed to look hard in the mirror to see how our behaviors were

8   contributing to the challenges identified by our stakeholders.

9   That look revealed that as we implemented requirements and policy

10   in this area, we sometimes introduced additional unnecessary burdens.   An

11   example of this was our evaluation of the digital I&C common cause failure

12   policy described in the SRM to SECY 93-0807.

13   So we've heard a little bit here about, wow, the Staff

14   determined that the policy didn't need to be modernized in that Commission

15   paper.   And I'd like to change the characterization of that because as we

16   started our evaluation of the policy, we initially focused on whether a policy

17   change was needed.

18   But as we got into the history, we revised our focus to ask

19   the question is the policy truly a barrier to us implementing any proposed

20   regulatory improvements that our stakeholders have challenges us to adopt?

21

22   And with this change in focus, it became clear to us that

23   the existing policy had plenty of flexibility to adopt things like risk-informing

24   other alternative standards and some of the things that were mentioned

25   today, but that our implementation of the policy, as we translated that to our

26   guidance documents, maybe made things more restrictive than they needed

1   to be.

2   So, second, we realized that no guidance document, no

3   matter how good, can succeed on its own. And I would extrapolate this to

4   no guidance document, no standard, no rulemaking. None of those are

5   going to be a panacea for any of the challenges we've faced.

6   Rather, for any of those things we do, we have to ensure we have

7   the appropriate companion support network to ensure its success. As we

8   like to past efforts, it was clear that sometimes in a guidance document we

9   devoted a lot of energy in conjunction with stakeholders to develop a good

10   guidance document, and then for whatever reason, that guidance document

11   sat on the shelf for some period of time.

12   When it was picked up to be used, implementation issues

13   were identified, some of the originators were no longer available so we

14   struggled with working through those implementation issues and at the end

15   of the day, the guidance document got billed as a failure.

16   So what we're trying to do differently today is in working

17   with our stakeholders we've identified these priorities, one of the priorities

18   was the risk to better enable 50.59 modifications.

19   We subsequently worked with industry to develop these

20   workshops which we've supported. We've made sure we've had attendance

21   at those workshops from both technical and oversight staff and management

22   from the NRC so that we're all hearing the same questions and answers.

23   We're aligning on regulatory expectations. Now we've

24   seen that seemingly has enabled the use of the risk to do digital

25   modifications so now we have inspection staff who are more plugged in.

26   We're taking all the questions and answers from those

1   workshops and those will be filtered into our more detailed training that we

2   do to our inspectors who will be overseeing these 50.59 mods.

3   So we're looking to leverage that same approach as we

4   keep rolling out these new guidance documents.

5   Lastly, we've revisited what information is necessary to

6   make regulatory decisions.   So for operating reactors, this most manifested

7   itself in our ongoing revision to ISG-06.

8   And as was talked about by several of the industry

9   stakeholders, the revision we're working on now will provide a regulatory

10   approval sooner than originally and previously anticipated, with the idea that

11   they'll get that regulatory approval before their final design and software

12   development is complete.   But it'll lock down the most important attributes

13   that we've relied on to make our regulatory finding and then it'll be primarily

14   the licensee's responsibility in conjunction with oversight of their vendor to

15   convince themselves that the system as designed meets those requirements

16   and will obviously have some amount of oversight of that activity.

17   And as also was mentioned for new reactors, this

18   manifested itself most recently in the use of the design-specific review

19   standard for the NuScale review by which we did identify some higher level

20   safety principles for the I&C review which allowed us to expedite and simplify

21   our technical review.

22   So with that, I'll now turn it over Rossnyev.

23   MS. ALVARADO: Thanks, Eric.   Good   morning,

24   Chairman and the Commission.

25   I'd like to talk about what we are doing to try to find

26   expectations regarding CCF, common cause failure, but before I do that, I

1   think it will be good to set up or provide a little bit of the background of what

2   is a digital system and why we're here and why this is an issue.

3   So digital systems offer many advantages over the existing

4   analog system.   The use of digital technology continues to be a key industry

5   strategy for addressing obsolescence and improving plan flexibility and

6   reliability, and therefore, reducing maintenance cost.

7   The Staff recognizes that digital technology can provide

8   many advantages but it also creates the possibility for new vulnerabilities.

9   In particular, there is wide consensus that the potential for

10   non-faults that can be introduced during the design and implementation of

11   the system could result in a common cause failure, which could challenge

12   redundant trains that use identical software or that use shared devices, for

13   example, communication networks.

14   Like analog systems, digital technology cannot be

15   completely tested so software design errors can be present in the system

16   and this will have effects until certain trigger events are present.   To

17   manage this uncertainty, licensees generally consider the defense in-depth

18   and ability to cope against common cause failure.

19   I'd like to highlight that common cause failure events are of

20   concern to both safety systems and non-safety systems.   So this is not only

21   an issue for safety systems.   For non-safety systems, Staff is seeing more

22   aggregation of control functions into one platform or one system.

23   Also, they're using the same platform for different control

24   functions.   In this case, a common cause failure of the system could lead to

25   new type of accidents or malfunctions that were not previously analyzed in

26   the plan's safety analysis report.

1   For this reason, both stakeholders and Staff recognize that

2   common cause failure is the highest technical priority to resolve for using

3   digital technology.

4   Also, common cause failure due to software underpins

5   many of the regulatory challenges and efforts to use digital technology as we

6   listen to the first panel this morning.

7   For example, I want to provide this example in which

8   industry stakeholders have identified challenges when determining the

9   likelihood of a common cause failure due to software when they perform

10 evaluations under Section 50.59. This is because there is not an accepted

11 method for quantifying the likelihood of a failure. So licensees have to use

12 qualitative assessment.

13   The question is how do you translate those qualitative

14 assessments to answer the questions in 50.59? The Commission's policy

15 to address common cause failure in digital systems is in the Staff record

16 memorandum to SECY 93-0087.

17   The Staff this year completed an evaluation on this

18 Commission's policy and its impact on licensees' activities. This evaluation

19 considered insights derived from the development of the RIS supplement

20 which Mike will describe in detail, significant interactions with industry

21 stakeholders, industry standards, EPRI and NEI documents, as well as other

22 Federal Agency regulations.

23   We also look at the lessons learned from all regulatory

24 reviews. This evaluation led us to the conclusion that common cause failure

25 due to software should be considered.

26   But all regulatory guidance should be improved to be made

1   more clear and consistent.   The Staff believes that the Commission's

2   direction in the SRM SECY is still adequate.

3   That position provides flexibility for accepting new digital

4   technology and support regulatory modernization activities for near-term

5   improvement, including the use of a graded approach and the use of

6   alternative industry standards.

7   Also,   the   Staff   believe   the   Commission   policy   is

8   technology-neutral and allows for the use of risk insight.   During our

9   evaluation, we determined that implementation of NRC policy has not been

10   consistent.

11   Eric alluded to this in his talking points, therefore, to

12   improve clarity, consistency and regulatory stability, the Staff identified

13   guiding principles that will be reflected in all common-cause-failure-related

14   regulatory guidance.

15   Our views are summarized in SECY 18-0090 which also

16   includes a brief plan for implementing these guidance principles and the

17   Commission's policy.

18   Next slide, please.

19   This slide summarizes these guiding principles which are

20   described in the SECY paper.   In particular, these guiding principles are

21   continue to address potential vulnerabilities to common cause failure,

22   continue to perform diversity and defense in-depth analysis for reactor

23   protection system and engineer system features actuation system to address

24   vulnerabilities to a common cause failure.

25   This analysis can be either a best estimate or a design

26   basis analysis as appropriate.   For other systems, we want the licensee to

1   continue to use a graded approach for performing a diversity and defense

2   in-depth analysis, which should be commensurate with the safety

3   significance of the system.

4   The next item is to clarify the use of alternative means to

5   address vulnerabilities to common cause failure and the last item that I want

6   to talk about is the use of certain design attributes to address common

7   cause failures.

8   But the use of these design attributes, we consider that

9   they should be commensurate with the safety significance of the system.

10   This proposed guiding principles are meant to ensure consistent application

11   of the Commission's policy as I mentioned before, and they will be used to

12   clarify NRC requirements for addressing vulnerabilities to common cause

13   failure.

14   The RIS supplement that Eric mentioned and that Mike will

15   provide, the detailed description about it, is consistent with these guiding

16   principles.   For example, one of the guiding principles is the use of a graded

17   approach.

18   In the RIS, we recognize this but using a graded analysis

19   and the commendation in relationship to the system safety significant to

20   determine the likelihood of our common cause failure.

21   Further, the use of a graded approach will be consistent

22   with the Agency-wide effort for implementing a risk-informed regulatory

23   approach.   These guiding principles will be incorporated into Branch

24   Technical Position 7-19 which provides guidance to implement the

25   Commission's policy.

26   And specifically, this BTP provides guidance for performing

1   diversity and defense in-depth analysis to demonstrate that vulnerabilities to

2   common-cause failures are addressed.

3   In addition, we will resolve comments provided by

4   stakeholders including industry on the current version of BTP 7-19.   In

5   particular, to clarify the scope of applicability, consideration of design

6   features to eliminate common cause failure from further consideration and

7   the overall need for diverse actuation.

8   In addition, we're also going to use these principles to

9   evaluate industry-developed guidance.   In particular, NEI is developing NEI

10   16-16 which the title is Guidance for Addressing Digital Common Cause

11   Failure, to provide guidance on using design attributes to reduce the

12   likelihood of a common cause failure or to eliminate common cause failure

13   from further consideration.

14   NEI provided a draft version for the NRC review and

15   potential endorsement, however, NEI's suspended work on this document to

16   focus its resources on the development of the RIS.

17   And because EPRI is revising the design guidance that is

18   incorporated into NEI 16-16, the Staff is ready to resume review of NEI

19   16-16 upon request by NEI.

20   As we address product modernization activities, we expect

21   that other common cause failure questions and challenges will arise.

22   A particular example is with regards to integration and

23   connectivity of I&C systems.   The ease of connectivity within digital system

24   architecture makes it easy for a single failure or a common cause failure to

25   occurring within one system to propagate to other systems.

26   This kind of event can create a malfunction or create a

1   problem that will prevent the system for recovering for a transient for

2   example, or to mitigate an accident.

3   Some of those systems were previously analyzed as an

4   independent or standalone systems with independent failure consequences

5   but as they get integrated, we don't know how they're going to behave so

6   this is something we need to consider.   Consequently, we will evaluate

7   the extent to which the Commission's policy needs to be modernized to

8   address new challenges or support potential changes to all regulatory

9   infrastructure.   I will now turn it over to Mike.

10   MR. WATERS: Good morning.   The majority of digital

11   upgrades to our operating fleet have been and will be implemented under 10

12   CFR 50.59.   This regulation provides conditions under which licensees can

13   make changes about prior NRC approval.   Some key criteria in the rule

14   include other proposed changes, increases the likelihood of a malfunction

15   previously evaluated, or creates the possibility of a malfunction with a

16   different result.   For digital I&C licensees who have faced past challenges in

17   answering these questions that involve potential common-cause failures.

18   We issued Supplement 1 to RIS 2002-22 in May of 2018 to

19   address this challenge.   The RIS primarily addresses auxiliary safety

20   support systems, non-safety systems and replacement of individual

21   components ensured to identify these modifications as higher priority.

22   Supplement 1 to the RIS provides clarification to determine

23   a more likelihood of a common-cause failure is sufficiently low to support a

24   change under 50.59.   The quality of assessment approach considers three

25   factors: the design attributes of the system; quality of the design process and

26   any relevant operating history with the proposed system.   To support this

1   assessment, the supplement also addresses key aspects of the engineering

2   failure analysis to identify CCF vulnerabilities.

3   The completion of the RIS was very challenging, but it was

4   ultimately successful because of significant interactions with industry experts

5   and the use of tabletop workshops to test the practicality of the guidance.

6   As you heard from the panel this morning, industry plans to complete a

7   number of upgrades using the RIS.

8   On a separate track NRC is currently engaging NEI on a

9   proposed Appendix D to NEI 96-07 for 50.59 evaluations. Appendix D is

10   intended to address specific digital technology issues and complement the

11   base guidance in 96-07. It will apply to all types of digital modifications and

12   it contains additional guidance for screening.

13   NEI is currently incorporating NRC comments and

14   observations that we provided in several public meetings. They plan to

15   provide Appendix D to us this December for formal endorsement to

16   Regulatory Guide 1.187.

17   Slide 10, please. Let me now transition to digital I&C

18   licensing. We have made good progress on licensing certification reviews

19   of new digital systems. This slide lists a few examples. We successfully

20   reviewed and licensed the Hope Creek Digital Power Range Neutron

21   Monitoring System. It is now up and running. We've also completed the

22   technical review of the NuScale digital I&C system that's part of the overall

23   digital -- overall design certification process.

24   Staff used an innovative design-specific review standard to

25   emphasize its fundamental design principles. We've also made good

26   progress in digital I&C licensing activities for research and test reactors.

1   For example, we've completed the safety evaluation of the license

2   amendment for the Purdue-1 reactor. As shown in the picture, this would

3   be a complete digital modification to all other safety and non-safety systems.

4   We expect to make a determination on the application very soon.

5   We highlight these to note they were continually examining

6   the insights and lessons from both site-specific licensing and the design

7   certification reviews to instill greater efficiency and predictability into our

8   guidance.

9   Slide 11, please. A key example is a revision to staff

10   licensing guidance in ISG-06 to address the near-term needs of the U.S.

11   operating reactor fleet. We expect to finalize the guidance this December.

12   The revision is focused on providing an alternative process for regulatory

13   approval of a major upgrade before a licensee makes a significant

14   investment in the development of the proposed system.

15   We added the alternative review process which shortens

16   review when a licensee uses an improved topical -- approved digital I&C

17   platform.   This process is based on a single submittal that includes

18   information on the final system architecture, human system interface and

19   software requirements.   It eliminates a license review of the detailed

20   software verification outcomes and factory acceptance testing results.

21   Therefore, our review will have greater focus on licensee software quality

22   assurance planning and oversight of their activities.

23   The staff review process also incorporate the evaluation of

24   fundamental design principles of independence, redundancy, repeatability,

25   and defense-in-depth.   These approaches are consistent with the

26   Transformation Team recommendations on use of design principles in our

1   guidance and oversight of digital I&C quality.

2   This activity has been successful because of our

3   significant action again of vendor and utility licensing experts. For several

4   months we have dedicated public meetings with the working group to

5   discuss each part of the revamped guidance. We also conducted a tabletop

6   exercise to test the the draft language in the ISG with past examples from

7   past licensing applications.

8   Slide 12, please. So this graphic depicts the difference

9   between the original two-phase licensing submittal process and the new

10   alternative review process. Both will be acceptable approaches in the

11   revised ISG. The blue portion in the middle shows licensing activities aren't

12   -- with respect to typical life cycle development process of a new digital

13   system from design concept to installation. The red line and green line

14   depict NRC's review time -- shorter review time with the alternative review

15   process. As shown, approval would be granted at the time when licensee

16   begins final implementation including software validation and fabrication.

17   The NRC may translate some of these -- some of the

18   licensee's commitments regarding software quality development and vendor

19   oversight into license conditions and subsequent NRC vendor regional

20   inspection oversight will be focused on the final design activities including

21   software quality, factory accepting testing, and site installation.

22   It is important to note that industry is developing guidance

23   for standardizing digital engineering and guidance for developing license

24   applications based on the new alternative review process. While we are not

25   involved in these efforts, we encourage this approach. This can be a very

26   important element in ensuring high-quality applications and contributing to

1   the consistency of our reviews for the next set of digital I&C license

2   amendments.

3   I will now turn it over to Dinesh.

4   MR. TANEJA: Thank you, Mike.   Good morning,

5   Chairman and Commissioners. Improving our review and oversight of the

6   commercial grade dedication process for digital equipment is another very

7   important area we're working on.   The nuclear industry relies on equipment

8   for the majority of the I&C systems.   Many vendors often design equipment

9   using non-nuclear international safety standards.

10   Staff is evaluating potential use of third-party safety

11   certification based on an international industry standard to accept

12   commercial grade equipment. In particular, NEI is developing guidance to

13   use safety integrity level certification to supplement the commercial grade

14   dedication of digital equipment.

15   So NEI is developing a guidance document based on EPRI

16   research in this area and they're also working with NUPIC to establish a

17   process for the oversight of these third-party self-certifying entities.   NEI will

18   be submitting a guidance based on their work for NRC's approval.

19   Staff believes that this use of third-party certification could

20   establish a streamlined commercial grade dedication process and facilitate

21   expanded use of commercial digital systems in nuclear safety application.

22   Slide 14, please. While working on the activities already

23   described, staff is assessing our regulatory framework to look for innovative

24   ways to address challenges and make broader strategic improvements

25   benefitting all stakeholders.

26   Staff is performing a strategic assessment to identify

1   impactful improvements activities consistent with Commission direction in

2   SRM-15-0106 and associated recommendation by the Transformation Team

3   on digital I&C. In doing so the staff will continue to consider the challenges

4   and potential impediments that may be unique to specific digital I&C

5   stakeholder communities.

6   We also continually engage the International Community of

7   Regulators to enhance our regulatory framework. We are working with the

8   international experts within -- through NEA, IAEA to develop consensus

9   standards and guidance based on the best practices.

10   In accordance with the Commission direction, staff

11   developed a design-specific review standard, DSRS, for NuScale design

12   review that is safety-focused and uses risk insights. For the I&C design

13   review the staff took into consideration all the lessons learned during

14   licensing reviews of the new large light water reactor designs and

15   emphasized the review focus on the fundamental I&C design principles of

16   independence, redundancy, predictability and repeatability, and diversity and

17   defense-in-depth.

18   Emphasis was also placed on a simple design that embraces the

19   fundamental I&C design principles to most efficiently and effectively

20   demonstrate compliance with the NRC regulation.

21   Building on these successes and lessons learned from the

22   NuScale I&C design review, staff is embarking on developing design review

23   guidance for the advanced non-light water reactor designs that is consistent

24   with the NRC's principles of good regulation and statutory requirements.

25   And it's performance-based, technology-inclusive, risk-informed,

26   safety-focused and allows for use of reactor design-specific principle design

1   criteria.

2   Finally, we continue to look for improved approaches to

3   incorporate risk insights into our decision making on digital I&C for licensing,

4   design certification, and inspections.   In support of modernizing the

5   regulatory infrastructure staff has initiated important digital I&C research in

6   the areas of risk-informing licensing, certification and oversight activities,

7   research on technical basis for addressing common-cause failure concerns,

8   and research on use of emergent digital technologies.

9   And to conclude our presentation I'll just turn it back to

10   Margie.

11   MS. DOANE: Okay.   So I'll wrap up quickly because I

12   see we're a few minutes over.

13   So I just want to make it clear that digital I&C is a priority, a

14   very high priority for me and for, as you can see the staff, and we recognize

15   the need to bring a risk-informed mind set to these issues and to continue to

16   look for new ways to embrace what the challenges are and to continue to

17   look for new ways to address these issues.   We want to enable the use of

18   digital I&C in a manner that protects public health and safety.

19   And then I'd like to just conclude by thanking -- well, first of

20   all, I'd like to thank all of these guys at the table, but also the other staff that

21   have helped me get up to speed as the various perspectives on the

22   Commission, talking about glazed eyes and things like that, you can imagine

23   where I came to this issue.   I've been drinking from a fire hose.   This is just

24   many issues and they've done a terrific job bringing me up to speed to give

25   me confidence to ask a lot of -- I've been asking a lot of very hard questions,

26   and I'm getting great answers.   And I think we'll be able to look at this

1   program holistically and continue to make progress.

2   I'd also like to thank the staff of NRR, Research, NRO, the

3   regions, and OGC who have worked diligently on these issues. And with

4   that, we're looking forward to your questions.

5   CHAIRMAN SVINICKI: All right. Thank you. Yes,

6   everyone on the staff panel and all those NRC staff who helped prepare the

7   information you presented today. We'll begin questioning again with

8   Commissioner Baran.

9   COMMISSIONER BARAN: Well, thank you all for your

10   presentations and for all your hard work. I know these are tough issues.

11   Some of my questions at least initially are going to be pretty similar to the

12   ones that I asked on the first panel because I want to hear the staff's views

13   on some of those same issues.

14   You all went into a pretty good amount of detail on these

15   five guidance documents that are being worked on. And I want to get the

16   staff's sense of if those five guidance documents are completed, how far

17   does that get us? Do we see that as effectively resolving the key issues, or

18   is it more of a short-term fix?

19   MR. BENNER: Thank you, Commissioner. I would say

20   that the guidance documents address mainly these key near-term

21   challenges. So opening up the aperture for using 50.59, writing some

22   streamlined licensing guidance. The one area where I think it goes a little

23   further is we are -- once we get the NEI submittal on commercial grade

24   dedication and the adoption of an IEC standard in that area, that goes a little

25   further.

26   So those are key things we need to do. The broader

1   activities that were already envisioned in the IEP and some of the things that

2   are envisioned in the rulemaking for transformation do go further because

3   they would further open the aperture for how we would use international

4   standards more broadly.   It would go somewhat further in particularly for an

5   advance reactor licensee to start with a much more clean sheet approach.

6   It would better enable that.

7   But I think there are other ways we could do some of that

8   in the near term.   But those other things would need to be done.   There's

9   still work to be done for if we wanted to adopt the IC standards, if we want to

10   focus more on safety principles, we'll need to do that work.   And whether we

11   do that in guidance space or do that in rulemaking space is one of the areas

12   where we would want to engage with stakeholders as to say, like you were

13   asking, what's the best way to sequence some of those activities.

14   COMMISSIONER BARAN: I'm asking that right now in

15   fact.   When you're looking at it now, what is the best way to sequence those

16   activities?   I mean, I have heard this concern and I can see it that basically

17   right now the staff is focused on these guidance documents.   And that if we

18   launch a rulemaking right now, we could lose focus on the progress we're

19   making.

20   Do you share that concern?   Are you envisioning initiating

21   a rulemaking in the near term?   Is that what you'd like the Commission to

22   decide?   Or do you see it being further down the road after we get a sense

23   of how far we've gotten with the guidance documents?

24   MR. BENNER: We wouldn't push a rulemaking near term

25   because I think particularly for this idea of -- I think you've heard from many

26   of the stakeholders and I talked about in what's enabled our success.

1   IEEE-603 is a fine standard.   Some of our implementation of it has provided

2   challenges.   If a licensee or industry or a particular vendor wants to

3   leverage a different standard, particularly one of the IEC standards, there is

4   a built-in provision in the regulations today in 10 CFR 50.55(a) to use an

5   alternative.

6   So given how we're trying to look at these issues, we could

7   open that aperture today without a rulemaking.   So from the sequencing

8   standpoint, could it be better to do that way now using that alternative path?

9   And then once we've demonstrated how that could be done, there could be a

10   longer-term rulemaking to really institutionalize that.   Sure.

11   So I think we have resources for the strategic initiative that,

12   in all likelihood if we started doing a rulemaking sooner rather than later, we

13   still have resources focused on the near-term guidance documents.   It

14   would be more on reshaping and reprioritizing those efforts we were going to

15   do in the broader strategic modernization that we would devote to the

16   rulemaking.

17   COMMISSIONER BARAN: It sounds like Ho might want

18   to chime in.   Or maybe it's less in sound and more in appearance.   So what

19   I'm trying to figure out is why I'm voting on this transformation paper, one of

20   the recommendations is do a rulemaking end of July and see to set

21   high-level performance criteria rather than bind us to IEEE.   And I'm trying

22   to figure out that's before us now.

23   Should I vote to say, yes, let's do a rulemaking.   Or should

24   I vote to say let's finish all these guidance documents, see where that gets

25   us, and then decide whether to do a rulemaking.   Does the staff have a view

26   about which of those two sequences makes more sense?

1   MS. DOANE: Okay. So let me -- yes. Well, and the

2   view is we want to do both. Okay? Because we put this proposal before

3   the Commission and we said this is something that we think would be

4   transformative. So the sequencing of it is I think that we will lose progress

5   on the five guidance documents if we were to say, stop doing this and do

6   this, or if we were to divert resources to do these two separate things.

7   That's exactly right.

8   So what we need to do is if we were to do both, what we

9   would need to do is what we have done is we've put this as the last

10   milestone. And so we see it as a sequencing of already in the existing plan.

11   We see the restructuring as a last milestone. So we see certain things that

12   we're doing that will answer both questions. It would help us inform us how

13   to create these high-level principles that we would put in this rule. But it'll

14   also help us create a more flexible approach to our existing regulatory

15   process. Okay?

16   So some of these things will be done at the same time and

17   already are being done because some things support both efforts, some of

18   the things that you learn. So those aren't the type of things that I'm talking

19   about.

20   But if we were to have something where we just threw out

21   all the rules and we try to come up with these high-level principles, at some

22   point in this journey, and I can't give you an exact, precise place where we

23   would do it. But because a rulemaking takes into consideration, as you

24   know, you have to set up the rulemaking. We would have to think about

25   how we would go about approaching it.

26   And a lot of things that aren't necessary for the technical

1   staff itself that are working on these five guidance documents, they wouldn't

2   necessarily have to be engaged.   But at some point, you have to integrate

3   the resources so that you have the right people testing your approaches.

4   So the way I would envision a rulemaking is toward the end of this process,

5   okay, in the individual action plan, a step 4 where it is right now, where it's

6   contemplated right now, and taking advantage of what we've already known.

7   But to me, what we had contemplated -- and Dan is here if

8   you want further comments on this.   It's throwing this out and it would be --

9   not throwing out.   That's not really a good word now that I just said we

10   would build upon it.   But it would be really trying to get ourselves to think

11   about an approach in a whole different way.

12   And yes, there are alternatives in 50.55(a).   But they're

13   measured against IEEE-603.   So you can continue to build flexibilities.   But

14   when we put this in the transformation paper, we believed that there was an

15   approach that, like Eric was saying, that would broaden the aperture.

16   So yes, we want a rule.   The timing of it would be toward

17   the end of the action plan.   And we would not do it in such a way to risk the

18   resource of that.

19   COMMISSIONER BARAN: If the vision of the rule is that

20   it would essentially allow licensees and vendors to use any number of

21   approved standards as long as those standards meet the high-level

22   performance criteria, does the staff foresee any major challenges with that

23   approach?   I mean, and Dr. Thomas, for example, in the first panel said, not

24   all standards are created equal.   Some standards are good; some

25   standards are not so good.

26   Are we putting ourselves in a position where this kind of

1   rule that we would have to have guidance on or affirmatively approve a large

2   number of standards.   And would that prove to be challenging or is that not

3   how you envision this going?

4   MR. NIEH: I'll take a crack at that one, Commissioner.

5   So I think in terms of looking at using different standards in the context of a

6   broader rulemaking, to me, I've been trying to myself understand what this

7   rule might look like.   In fact, I wrote down a couple ideas down in my mind.

8   Again, I'm not going to share them with you here but of what a performance

9   based high-level rule could look like.

10   And I do think the concept you just described is possible to

11   have, again, a high-level set of performance criteria.   And if a standard does

12   meet that, with the right guidance from the staff, I think it's possible to have

13   that type of framework.

14   But what I wanted to point out, I guess, tying back to your

15   other questions as well in terms of what we're doing now.   I see what we're

16   doing now is complementary to a broader rulemaking effort should the

17   Commission decide to go down that path.

18   Moreover, if you did go down the path of approving a

19   rulemaking to establish a higher level performance based framework, my

20   feeling is we're still going to need to develop some implementing guidance

21   so the staff can use it and the industry can use it in guiding their work.

22   In terms of the resources, from my perspective here, if

23   there's a demand from the industry to conduct license amendment reviews

24   to do major modifications to their facilities, that's a priority I would see for the

25   operating reactor business line.   And we're going to figure out how to do

26   that first.

1   And again, as Margie says, we think we can do both.   But

2   I would not envision any situation where if I've got a demand for regulatory

3   guidance and activity to introduce more digital systems in nuclear power

4   plants, I would prioritize that over sort of the rulemaking efforts in terms of

5   where am I shifting the technical resources to get the work done.

6   So I think, again, it's possible to do both.   I would consider

7   as the director of NRR that real time, real life upgrades using digital systems,

8   that would certainly where I would focus my priority.   And at the same time,

9   we'd have to figure out how to continue through the rulemaking process too.

10   COMMISSIONER BARAN: I appreciate that.   And I don't

11   want to go too much over my time.   But I thought the chairman made a good

12   point about a lot of energy goes to, at NRC, trying to figure out whether we

13   agree with a licensee that they've met a particular code and standard.   And

14   that's one of the reasons why we have a lot of guidance, right, to provide

15   clarity to both our reviewers and to licensees or applicants about what do we

16   think is going to be adequate to meet a particular standard.

17   And part of -- and this isn't -- I don't mean this as a

18   negative concept about this concept or the rule.   But I wonder whether if

19   folks come in with 20 different standards under a rule, are we in a situation

20   where to make this work in the real world, we've got to do 20 giant guidance

21   document efforts to explain what would satisfy us under any of these

22   standards?   And is that going to be really hard?

23   MR. BENNER: Yes, I think our hope would be that

24   because there are a number of different standards out there that people

25   could use.   Our hope would be that we could have some engagement with

26   the stakeholders to narrow those things that they would most like to use.

1   And you've heard IEC here a lot.   There are areas where we agree that the

2   IEC standards are very sound and we could do something to look at that and

3   embrace that it would meet safety standards so that licensees could

4   leverage that.

5   COMMISSIONER BARAN: It's probably manageable.

6   MR. BENNER: Yes.   Well, that would be our hope.

7   Truly, if all of a sudden everyone comes in because as you've heard there

8   are standards in FAA, standards in automotive, international standards.   So

9   if everyone picked a different one and tried to come in with licensing actions

10   to use all different ones at the same time, that would be an unmanageable

11   situation.

12   MR. NIEH: Just one additional point, sir.   This is already

13   happening today in other technical areas, in other regulatory programs.   So

14   the concept is in my view not really foreign is I've looked at what other

15   international regulators are looking at in terms of allowing different standards

16   to meet high-level performance criteria.

17   Again, I think about what the chairman said in the external

18   panel about having too much flexibility.   That's something we need to be on

19   guard for.   But having the right performance criteria, like, what are we really

20   looking for the standard to meet.   Then it's on us to do our review to see if

21   the standard does indeed meet that.

22   So to me, I see people are already doing it, maybe not so

23   much in the United States in the nuclear industry.   But I think it is done and

24   it's possible.

25   COMMISSIONER BARAN: I've gone well over.   Thank

26   you.

1   CHAIRMAN SVINICKI: All   right.   Thank   you.

2   Commissioner Burns?

3   COMMISSIONER BURNS: Oh, it is on.   Okay.   So I still

4   have the veil and I think I'll always have the veil on this issue.   So this is

5   how I would characterize what I've heard in some respects is that we see our

6   ability to make progress in this is to be what I'll call a little bit of pretzel

7   twisting.   And that is we sort of twist ourselves -- stand there and twist

8   ourselves into a pretzel to be able to make progress because we feel

9   confined by either existing guidance, existing regulations and all that.

10   So the objective might be, and it might be through the

11   transformation paper, to make us standing up straight again and doing it.

12   Now, that's a rough metaphor, analogy, whatever you want to say.   But then

13   I hear that in areas like the APR-1400 and NuScale and some of the other

14   things, we sort of made that progress.

15   So if you can, tell me what it is that would make -- what

16   would be the regulatory change you would make that -- how would that

17   regulatory change improve the way we've gotten there today?   Now, maybe

18   it eliminates, as I say, the pretzel twisting and the contortions we have to do.

19   But that's what I'm trying to understand here.   Because at one level, what I

20   hear is, it's hard, it's hard, it's hard.   But we can get there.   And anyway,

21   have at it.

22   (Laughter.)

23   MR. TANEJA: Okay.   So to answer your question, the

24   DSRS that we did for NuScale, it was a paradigm shift.   Same regulation.

25   The only thing that we changed was how we look at these things.   The

26   paradigm shift was our current practices are if a design meets regulation

1   equals safety.

2   Here what we said was, is the design safe?   If the design

3   is safe, then demonstrating regulatory compliance is very easy.   So that

4   paradigm shift really streamlined the way that work progressed.   It was the

5   applicant embraced the concept so they really came in and they

6   demonstrated how their design was safe.   And so the complying with

7   regulation was demonstrated.   It was much easier to go around that way.

8   So maybe it is part regulation, the way they are structured.

9   And maybe it's culture, the way we have been practicing how we do our

10   business.   So there is some of that was a mindset change and culture

11   change that was helpful in that area.   So it's a combination of things.

12   MS. ALVARADO: I just want to add one thing, and maybe

13   this will help you see the pretzel untwist is that we need to really understand.

14   And this we learn as we were working on this, like, the different

15   communities that we need to serve.   So for new reactors, we have our

16   regulations, right?

17   So if I'm coming with a new design, I can do anything to

18   meet that regulation, right?   Like, if I require you to perform a D3 analysis

19   for all your system, you can do it because you don't need to stop operation,

20   you don't need to change anything.   It's a blank sheet.   You can start from

21   zero.

22   The problem is for operating reactors is that they have a

23   licensing basis that they need to meet.   They have systems that are

24   operating.   They have regulations that they need to meet.   So for them is

25   where you see all these pretzel twisting trying to -- I want to change this

26   system, but I have to fit in this box that we have set up by the regulation.

1   So that's something that has created the flexibility,

2   innovation, transformation that we have seen in the new reactors that maybe

3   we are not there.

4   MR. NIEH: Thank you, Commissioner. D3 is Diversity

5   and Defense-in-Depth just for people following here. To get at your

6   question on what regulatory change is needed, I think Dinesh raised a point

7   that is very near and dear to me because I do feel that the way we're

8   approaching these reviews can significantly have an impact on how much

9   time we're spending and where we end up in the end and how long it takes

10 us to get there. And from my perspective, I think it came up in the external

11 panel the idea of reasonable assurance: trying to find every single ghost in

12 the machine, eliminating all risk.

13   I think from what I've seen in the two months I've started to

14 study this issue to look at how NRO is approached and how NRR is

15 approached is I see that the mindset attribute is pretty significant. So I

16 would not want to let that one fall off the table. And I feel that that falls onto

17 the leadership of the people at the NRC staff in trying to guide this idea of

18 enabling technologies and focusing on reasonable assurance.

19   But in terms of regulatory changes, Commissioner, I think

20 other things that we're moving toward in doing now today are things that we

21 could consider building into our framework such as early engagement with

22 vendors and the industry at the design phase.

23   Again, you heard that before that that's a key element. I

24 see it happening in other areas. Look at what we're doing in accident

25 tolerant fuels. We're engaging with vendors up front, okay, and the

26 licensees that are thinking about using those fuels. Again, that's all to have

1   a more efficient review process. And I think we need to apply that

2   philosophy in digital I&C.

3   And as I mentioned in the earlier remarks, I think, again, I

4   don't know if this is rulemaking or not, but leveraging experience from other

5   industries and technologies. I mean, we heard it very clearly this morning

6   that a lot of industries are using these systems. And again, maybe they're

7   not seeing as many common cause failures as we think that are really that

8   likely.

9   So to me, as the director of NRR, I'd like to understand that

10   better and to see to what extent that operating experience could be fed into

11   the knowledge that we're trying to use in making a regulatory decision.

12   COMMISSIONER BURNS: Another question, there's a lot

13   of talk of an old SECY paper which is kind of interesting, SECY-93 -- thank

14   you -- 93-0087. And I got sort of mixed feelings from hearing some of the

15   presentations and I think the staff is trying to, I think, build from it. But I

16   almost got in some of the early presentations, I'll paraphrase Shakespeare, I

17   come here not to praise 93-0087 -- thank you. I come here not to praise

18   93-0087 but to bury it.

19   How would you react to that? I'm just trying to put that in

20   sort of context about where we're going. I'm going to Shakespeare Theater

21   tonight anyway. But I hate to say it. It's a Comedy of Errors which I don't

22   think is appropriate for this meeting. Anyway --

23   (Laughter.)

24   MS. DOANE: Maybe I shouldn't be the one going on top

25   of that, Comedy of Errors. I would tell you that what we are trying to do so

26   that we can get some efficiencies is not rework everything, okay, at this

1   point.   We're trying to make progress by using what we have and then

2   seeing if it can propel us forward.

3   So the question we were asking about 93-0087 was

4   whether we needed to go to the Commission to get some policy changes so

5   that we could continue working.   And that would've slowed us down just

6   because we would've had to write a paper, right?   We all would've had to

7   look at this in a different way.

8   So when we say that it works for us, it works enough for

9   us, what we're trying to say is -- and I think Eric did a good job or maybe he

10   might want to say something in addition.   What we're trying to say is these

11   basic principles are good.   But we have to bring this risk informed mindset,

12   this culture change that is happening at the agency.   I'm seeing it in many

13   different areas.

14   We have to bring that to the principles in 93-0087.   And

15   we believe that we can, that it allows enough flexibility and it provides the

16   basic framework that we need, that we don't need -- there's no policy issue.

17   That was really the question.   Is there a policy issue that needs to be

18   resolved?   And we don't see that.

19   So I hope that's -- so it's an answer.   It's a "yes" and a

20   "no".   It's not -- if we use the same approach we were using in 93, that

21   wouldn't be the right way to go.   We know that.   But if we use those

22   high-level principles, those five guiding principles and our new mindset, we

23   think that's a good path forward.

24   Eric, did you --

25   MR. BENNER: I would just echo that, that the strict

26   language in the policy provides adequate flexibility and us looking at, okay,

1   how can we more risk inform? How can we more use a graded approach?

2   How can we more leverage international standards? We just need to do

3   that. We don't need a change to the policy to enable that.

4   COMMISSIONER BURNS: Okay, okay. Last question

5   I'm going to ask Ho having come back from NEA. And you've noted it a

6   couple times. So who out there would you look to? I mean, we had the

7   example of STUK in terms of their approaches. And I talked to Mr. Scott

8   after the presentation. And it's not just about Olkiluoto. It's about other

9   things they're doing. But maybe if you could give some more perspective

10   on what you're seeing or where you think some of our perhaps learning

11   might come from.

12   MR. NIEH: Thank you, Commissioner. So building on

13   some other comments on the international experience, I still think there are

14   opportunities to learn. It was mentioned in the earlier panel and perhaps

15   briefly on this one too that there are some activities related to digital I&C

16   bringing the international regulators together to look at what frameworks

17   they're using to address common cause, what type of standards they're

18   using.

19   And the playing field is not even in all countries. Some

20   countries have more readily welcomed digitalization. We heard from an

21   external panelist this morning. He was working at Pickering in 1979.

22   Canada, it's interesting. You go north of the border, digital seems okay.

23   You come down here, there's some challenges.

24   So I think learning from those experiences are really good

25   in the case of Finland and Olkiluoto with their APR. The regulator at the

26   time when they made the licensing decision, I guess it was some time ago,

1   they did ask for an analog backup system to be installed.   But having

2   spoken with the head of the regulatory body more recently, I understand that

3   the Finnish regulator, they've learned a lot more through the operating

4   experience.   And they might make a different decision today if faced with

5   the same application.

6   So I think our continued participation in some of these

7   international working groups will help us see the picture better.

8   COMMISSIONER BURNS: Okay.   Thanks.

9   CHAIRMAN   SVINICKI: Thank   you.   Commissioner

10   Caputo.

11   COMMISSIONER CAPUTO: Hi.   I'm going to start by

12   thanking the staff.   I know it takes a lot of time and effort to prepare for this

13   kind of a meeting, particularly for those of us who have our eyes glazed over.

14   So let me just start by paying you the compliment for putting the time and

15   effort into today's meeting that you clearly have.

16   But as I was preparing for the meeting, I read a SRM from

17   a Commission meeting in 2006.   And the SRM Commission directed senior

18   managers to; engage industry and establish an NRC project plan with

19   specific milestones and deliverables to address deployment of digital I&C,

20   short term milestones.   And the plan should address critical path actions.

21   The long-term objective of the plan should be to establish regulatory

22   requirements, standards, and guidelines as appropriate that allow licensees

23   to implement digital enhancements without undo necessary regulatory

24   burden.

25   Now, to me, this sounds a lot like the guidance that the

26   Commission gave the staff in 15-106, the basis for the current integrated

1   action plan that the staff has developed.   So being new to the Commission, I

2   obviously have to consider this issue from this new vantage point.   But I will

3   also make an observation that I made to the earlier panel.

4   From my previous position working in oversight of the

5   NRC, I saw previous commissioners dedicate significant time, effort, energy,

6   very earnestly believing that they wanted to solve this problem.   And

7   likewise, I'm sure previous NRC staff were just as confident that their plans

8   would achieve a successful resolution of the issue.   But here we are, 30

9   years into this issue, still meeting.

10   And so given the history here, I find it very hard to believe

11   that this is a matter of resources.   I find it difficult to think that this is really

12   an area where we need to be spending a lot of research time because we've

13   clearly been studying this for quite some time.   I'm certainly confident we

14   have the skills and expertise to solve this problem if we choose to.

15   So I guess that leads me to a question of leadership.

16   Margie and Ho, you're new to your positions.   Do you believe we have the

17   will as an agency to solve this problem?

18   MS. DOANE: So thank you for that question because

19   maybe it's the most important issue that we have to come to grips with

20   because we do have the technical expertise.   And I'm going to tell you, like I

21   said -- and I understand where you're coming from.   I sat in that seat.   And

22   before that, I was in an international position seeing just what Ho is seeing

23   where our international counterparts are making progress on this issue.

24   And I believe that we are different today than we were in

25   2006.   And here is the difference that I see all across the agency.   We have

26   a transformation mindset, an innovative mindset.   And it's being embraced.

1   And maybe it was sparked because we had to license to be a good

2   regulator, right? We had to be reliable. We had to be predictable. We

3   had to be efficient. Those are our principles of good regulation, and we did

4   that with new reactors.

5   And we now know that we can bring that new mindset to

6   these old problems and get through it. And I believe that that culture shift

7   was what was missing. So that's part of it. That's part of it. And then I

8   think part of it will be that once you get to that point that when you engage

9   with these communities, you'll start to see some of these challenges as

10   surmountable because we will be able to embrace the risk in a different way.

11   But I will tell you I'm seeing it all throughout my leadership

12   here so far, it's difficult. We are good at putting things in place because we

13   say, oh, there's a safety issue. I'm going to address it. I feel good. I

14   addressed it. It's very difficult for us to then pare back from that. And that's

15   what Eric was talking a little bit about.

16   It's harder for us. I'm just saying as a cultural problem --

17   not a problem but a cultural challenge. It's harder for us to then take things

18   away and convince ourselves that we're too safe. So we did not have this

19   culture shift. We didn't have behind us these new technologies that we

20   have licensed. We didn't have this concerted effort going throughout the

21   agency. And I see this as fundamental.

22   As leaders, we are going to have to continue to press this

23   and make sure that we stay focused, maintain public health and safety,

24   common defense and security. Stay focused but introduce these risk

25   insights and this risk informed mindset. It's always been the goal of the

26   Commission. I absolutely agree with you. What's different now is we're

1   really concentrated on the mindset. And we are coming at that with training

2   and tools and really thinking about, how do you really get there. I see that

3   as the difference.

4   Ho, did you --

5   MR. NIEH: To answer your question, yes, I do believe the

6   will is there. As Margie pointed out, there's a leadership issue and then

7   there's also this mindset issue. And that's where the leaders come into play

8   is to help bring the agency into a place where it can fulfill its mission for

9   reasonable assurance of adequate protection and again look at its function

10   in trying to enable these technologies. Because I do feel that we also as a

11   regulator need to look at our role in nuclear.

12   Not in terms of promoting because we don't promote the

13   technology. That's not our job. But if we're doing our jobs in a way that

14   takes nuclear off the table for the private industry and policymakers to see if

15   nuclear is an option going forward in the future, then I would say then we

16   failed because we haven't conducted our control activities in accordance

17   with the Atomic Energy Act to maximize the general welfare of this

18   technology.

19   So kind of looking at things through that lens. And I think

20   again trying to shift this mindset in terms of enabling while it's safe. How

21   can we do this to make sure it's implemented safely? To me, I think this is

22   an important part of the leadership challenge we have at the NRC.

23   COMMISSIONER CAPUTO: So I guess I'll start my next

24   question by saying sometimes it's destination and sometimes it's a journey.

25   In looking forward to the staff's revision of the integrated action plan, is it

26   going to have a defined endpoint and are you confident that we will achieve

1   a successful result instead of just progress?   Is there an end to this

2   journey?

3   MR. BENNER: Yes.   It's not defined in the upcoming

4   revision to the IEP.   But Commissioner, myself, I'm somewhat new to this

5   program.   And I've been asking that question, what does the end look like?

6   So we do need to have that discussion because we'll always be doing some

7   process improvements.   But I think for me a key factor in what will the end

8   look like needs to be more stakeholder engagement because I think it goes

9   back to what Commissioner Baran said.

10   We're doing a lot of stuff at one level.   And once that stuff

11   is out and is being used and we're verifying it's being used effectively and

12   there's no implementation issues, that's a time we have to take a hard look

13   at both what's left to do, and that could take the form of a rulemaking or

14   policy change or whatever broader activity, and then what is the endpoint?

15   So I'm sorry to say the endpoint isn't currently defined.

16   But I believe that particularly now that these tactical efforts are nearing

17   completion and we'll get some runtime with them with the industry.   That will

18   put us in a much better place to align on what done looks like.

19   COMMISSIONER CAPUTO: Well, I'm a strong believer of

20   beginning with the end in mind.   So I'm glad to hear that.   I guess the last

21   question I would have is, with the end in mind, once it's defined, how are you

22   going to measure progress in terms of, well, progress and results?

23   MR. NIEH: I'll take a shot at that one.   Okay.   Because I

24   thinking about what success might look like and how --

25   COMMISSIONER CAPUTO: How do you know you're

26   going to make it.

1   MR. NIEH: -- do you know. So I would make one point

2   first that the fact that things are happening in the power plants today under

3   50.59. That, to me, is a step in the right direction. It's a positive trend. So

4   things are happening. That's a good thing.

5   But in terms of what we're looking at here more broadly

6   and what is success for digital I&C and my mind as I was thinking about your

7   question, Commissioner, success would mean to me that we have a level of

8   proficiency in doing DI&C license amendment requests and reviews and

9   digital is not, quote, a special topic anymore. Okay? We're proficient at it.

10   We've got it built into the systems. The licensees, applicants have a

11   framework that they clearly understand. They have a good sense of what

12   the expected review time would be like.

13   So in my mind, as we're developing and doing these things

14   that are making our guidance more clearer, our expectations more clearer,

15   the engagement we're having with the industry. Once we start seeing more

16   licensing activity coming in, I think that's what we're going to need to

17   measure ourselves. Again, are we doing these consistently on time? Are

18   they predictable? Are we looking at different systems that are generally the

19   same and asking a bunch of different questions?

20   So those are the types of things in my mind that I would

21   look at in terms of trying to figure out are we having success? And I do

22   want to point out that we do have some technical work ongoing in NRR with

23   digital systems. We have a number of topical reports that we're looking at.

24   And we've all pointed out at the table today there's things that we've done in

25   the office of new reactors as well.

26   So I think once we start getting more proficient again. If

1   the industry has the confidence in us that we do have this new mindset and

2   we do have clearer understanding of the expectations, once we see the

3   increased activity in the licensing work, I think that's what we're going to

4   need to measure.

5   COMMISSIONER CAPUTO: Thank you.

6   CHAIRMAN   SVINICKI: Thank   you.   Commissioner

7   Wright, please proceed.

8   COMMISSIONER   WRIGHT: Wow.   Thank   you,

9   everybody.   It's been very interesting, a little deep.   And I'm coming away

10   with more questions than I came in with.   And Margie, I appreciate the

11   comments you made.   And the transformation thing, one of the things I'm

12   struggling with is, what are we transforming to?   It just seems like -- I mean,

13   I know we're trying to make progress.   And what's the endpoint?   I hope it's

14   not 30 years more.

15   We've already heard from the first panel that the industry

16   doesn't really want to be -- the licensee doesn't want to be the first up

17   because of the experience that we heard that Oconee had.   And I asked the

18   question earlier how and you've talked to it a little bit a couple of times here

19   already when I was asking about the reasonable assurance of adequate

20   safety versus zero risk.

21   And we heard in the first panel that they felt like it had

22   been leaning more toward zero risk thing looking for the ghosts everywhere.

23   But they did say that the transformation team that was working on this stuff

24   that it seemed like there was some progress being made.

25   Can you speak a little bit more to that, either one of you,

26   anybody really?

1   MS. DOANE: Okay. So I'm going to start at the higher

2   level obviously because -- and maybe I'm fortunate in that I don't understand

3   the complexities at the level that these very smart people that are flanking

4   me on both sides have. So I'm coming at it more from a process

5   perspective.

6   But what I will tell you is that I don't think any of us sitting

7   here would say that our approach over the last few decades because, right,

8   the military has been using digital I&C equipment since I heard the '50s. I

9   don't know if that's true, but I hear different things all the time.

10   So we wouldn't defend that some of the approach, while

11   we call it risk informed regulation, that some of our approaches had really

12   been risk informed. Nobody is sitting here defending that. In fact, it's just

13   the opposite.

14   So what the transformation effort is doing is it's trying to --

15   that's right -- it's trying to reeducate the staff at a fundamental level. I don't

16   know if you had an opportunity to see a letter that Fred Brown had sent to

17   his staff and NRO about adequate protection. And just the fundamental

18   rethinking of what adequate protection means versus zero risk. And it's

19   complex to discuss these issues, but we have to continue to do that because

20   that's how we're going to get this shift.

21   And so what you'll hear now very commonly when you

22   come into meetings is you'll hear, okay, before we start this endeavor and

23   we start all this big project and we put all these resources in, what's the risk?

24   And then once we get to that, we start to unpeel what's the action that we

25   should take. And that is very real in this group.

26   So we aren't there from an agency. We're not there. But

1   we have a lot of people who already are. And we're continuing to work on

2   these issues, and it takes a different forum and a different presence

3   depending on what the area is. And for something like this which is very

4   complex, many different communities, many different perspectives. You've

5   heard Mr. Thomas, he had a completely different perspective.

6   So I think that when you say, where do we want to be? I

7   was thinking last week, I want to be where the airline industry is. There's all

8   these planes flying around. They're all digital. We're saying, that's where I

9   want to be. But then Mr. Romanski came up today and he said, well, we

10   have some software. Yes, we have this. But then there are these other

11   few items that we haven't cracked the nut yet. And I thought, oh, okay.

12   So what that tells you is you need a framework that not

13   only solves the issues for today but that may be at a high principled level. I

14   don't remember exactly what he said. I think he said that addresses

15   overarching properties and lets us work within that.

16   But on your philosophical question about where are we

17   transforming to. We're transforming to a place where we can be -- we

18   understand. There are new issues coming in from existing licensees,

19   advanced reactors. Now, they have questions from the vendor community.

20   We're transforming to a place where we can answer these questions in a

21   predictable, reliable, and effective and efficient way.

22   Those are all words I'm throwing out. But what I'm trying

23   to create as a vision for you is that we will get more comfortable as we

24   challenge ourselves to really start with this question of, well, where is the risk

25   here? Where is the gap? What are we really trying to fill?

26   We're going to get to that, that high-level vision that we can

1   get these very vexing questions, very hard questions in and we can resolve

2   them.   And they really do take risk insights into consideration.   We make

3   good decisions that maintain public health and safety.   But you're right, they

4   aren't directed at zero risk which we know we can't achieve anyway.

5   COMMISSIONER WRIGHT: Do you have anything to add

6   at all, Ho?

7   MR. NIEH: Maybe just one point.   I was also going to

8   mention the memo that my colleague, Fred Brown, issued.   I thought that

9   was a great memo.   In fact, we even talked about that's something that

10   should've gone to both business lines.   And so reemphasizing those things

11   were really good.

12   I just would add one point that came up in the early panel

13   about the what ifs and what FAA had talked about is we defined when you

14   stop the testing process.   And I think that's what we need to do here, sir,

15   quite frankly is that we can keep asking what if, what if, what if.   Okay.   I

16   was a former inspector.   I mean, my mantra was go out -- they told me to go

17   out and find problems.

18   And I think you can go out and find problems.   But not all

19   problems are the same size.   And I think that philosophy applies to sort of

20   the what ifs.   I mean, you can keep asking what ifs to the nth degree.   But

21   some of those what ifs are not going to -- even if you get the answer, it really

22   isn't going to improve the whole safety review process.

23   So I think there's that mindset to say that you know what?

24   What we have is sufficient to make a regulatory decision.   There are a few

25   what ifs left of the table.   Let's move on from that.   Again, that's where the

26   leadership comes in.   That's where the first-line supervisor comes in.   And

1   it's a discipline that we have to apply in the process.   It's the same thing with

2   the refocus on backfit.   I kind of see if very similar.

3   COMMISSIONER WRIGHT: Yes.   Well, and Dinesh had

4   mentioned it and the other technology, the paradigm shift.   If it was proved

5   safe, then the rest of it could be done.   So I'm hoping that we can get there

6   when the operating reactor side of things because I know that's where it's

7   stuck.

8   I want to go to one other thing.   And Eric, while I've got the

9   time left here.   On the software side of things, I've heard -- and Dinesh was

10   speaking more of third-party certification in relation to the commercial grade

11   dedication stuff.   So when we're looking at third-party verification or

12   certification, would it help in the software part to have third-party certification

13   in the development process of this?

14   MR. BENNER: I think it would.   I mean, that's one

15   component of it.   I think this whole idea of what level of quality control and

16   quality assurance is necessary is also built in to the certification process.

17   So I think that would be a contributor to giving us -- I mean, you've heard a

18   lot here of we have the standard of reasonable assurance.   And you heard a

19   lot of stakeholders talk about adequate confidence.

20   And those obviously aren't the same two phrases.   But at

21   the end of the day, that's where the convergence needs to come.   Do we

22   have confidence that software was developed in an environment that allows

23   us to say, yes, that's good enough and that allows us to make a reasonable

24   assurance finding.

25   COMMISSIONER WRIGHT: So what do you think we

26   would need to leverage that approach?

1   MR. BENNER: Well, right. On the particular aspect of

2   the self-certification being envisioned, EPRI is currently evaluating that. NEI

3   is going to take the results of EPRI's research and make a proposal to the

4   NRC. So we're just waiting for that. Instead of us independently figuring

5   that out, industry has said, here's how we want to approach it. And we've

6   said, wonderful. That's in the IEP with really a placeholder for getting that

7   product and doing a review.

8   But I mean, the staff is pretty energized about that aspect

9   because we agree. There are these vendors making good stuff out there

10   that are doing it under the auspices of IEC. And anything we can do to

11   allow that good stuff to be used by our domestic licensees, we want to try to

12   --

13   COMMISSIONER WRIGHT: Good.

14   MR. BENNER: -- enable that.

15   COMMISSIONER WRIGHT: Okay. Thank you.

16   CHAIRMAN SVINICKI: Well, thank you all again. It's

17   been, I know, a long morning. It's been a really interesting morning. I just

18   want to share a few thoughts on some narrow things and then make some

19   observations. On the break, as we reset between the panels, I had

20   mentioned earlier that the FAA had talked about some sort of staged

21   engagement that they found really useful with vendors of digital

22   technologies. And I compared it to our regulatory engagement process with

23   advanced reactors.

24   I was informed, though, that -- and I want to give the staff

25   credit for this. I was informed that something akin to that does happen in

26   terms of pre-application meetings with the software vendors and the

1   designers of these platforms and that there's also topical reports. I think it

2   was mentioned to me but then I thought of that later. So I think we have

3   some surrogate things. So I didn't mean to depict that there was no

4   concept that was akin to this that was happening.

5   Also was commented to me by one of our vendor

6   presenters on the prior panel that it's extremely useful, both of those things,

7   that opportunity for topical reports and the pre-application engagement is

8   something that can really help make success of a much greater probability.

9   I want state that I'm still kind of going back and forth. My

10   colleague, Commissioner Baran, has asked good questions about

11   rulemaking versus what should we prioritize. The human capital aspect of

12   this is we tend to forget. We think that we have legions of people doing this.

13   We don't. The industry doesn't. So we do need to approach that with

14   thoughtfulness. And I don't know that Commissioner Baran got answers

15   that allowed him to take a firm view as he walks away from the meeting

16   either. There's a lot to think about there.

17   I would note, though, that the staff requested a number of

18   years ago to create different centers departing from the kind of office

19   structure and program structure that we have. One of those is the center for

20   rulemaking. And the concept behind that, as I understood it, might align

21   really well with what we've been talking about today. It was, as I

22   understood it, to say, okay, you have deep experts that are going to be the

23   subject matter people on something on which we want to engage a

24   rulemaking process.

25   But they're probably doing other things. They're probably

26   doing day-to-day safety reviews, reviewing topical reports, doing

1   pre-application engagement.   How could we take the mechanical processes

2   of rulemaking and have a center where people were truly expert in

3   rulemaking itself and they could be kind of harvesting things from the

4   ongoing work of the experts, plugging that in, maybe not doing every

5   provision of a draft rule.   But they could be easing some of that for the

6   people who are the pure subject matter experts.   And it was kind of a

7   specialization to let some people focus on rulemaking.

8   That may be actually be something that could be a key

9   enabler for us here if we wanted to walk and chew gum at the same time.   I

10   didn't want to use that parallel.   But if we wanted to at least begin the

11   beginning mechanical stages of a rulemaking to capture whatever are going

12   to be the high-level performance based objectives for the new paradigm

13   shift, we could do that.   We could keep the experts focused on completing

14   the other documents and maybe just be extracting the learnings.

15   I think either Ho or Margie talked about, we're going to

16   draw from the guidance work and the other things.   And we would put that

17   into a rulemaking.   So we may be able to keep some things in parallel and

18   not have to do everything in series.

19   And I just wanted to -- I think -- as I prepared for this

20   meeting, I thought that it may be that the staff, all their hard work of all the

21   years that I've been watching them struggle with a lot of this, they may just

22   be turning the corner.   And in some ways, it's the worst possible time to sit

23   in EDO on a Commission and others and we have to opine and all the

24   struggles.   And we draw a lot of attention in the rearview mirror, like, where

25   have we been and how hard it was.

26   I share the view of the director of NRR, of the executive

1   director for operations. I do see things happening here. Two papers I'm

2   working on right now as the staff has before the Commission, kind of a

3   paradigm shift, new thinking or the recognition that new thinking is possible

4   on physical security for advanced reactors. And I'm not going to remember

5   the SECY numbers of these papers. It doesn't matter.

6   Another one is a concept called functional containment

7   meaning, is there something about new fuels and new reactor designs that

8   would allow us to think very differently about something that is such a

9   touchstone that we do, that concept being containment? Could we think

10   differently about that?

11   So I don't want the staff -- I think it was really valuable for

12   the Commission to focus on digital I&C today. But I see the same kinds of

13   things that when the staff says, we're in a different place today. I see it as

14   well. It's not just this topic or the two I just mentioned. It's a lot of different

15   things that we're doing.

16   And I think the other difficult thing about transformation is

17   that there's this optic that somehow it means that you were wrong before.

18   You were misguided or you had some sort of enlightenment. I think it

19   comes from Alice in Wonderland where she says to the Cheshire cat or

20   somebody. She's like, it's no use talking about yesterday because I'm a

21   different person today than I was yesterday.

22   Because we're all having experiences and we're learning

23   things. And I think at NRC, the concept of continuous improvement may

24   sound a little trite. But it is part of the culture here. And so we can

25   fundamentally look at something differently today. It doesn't mean that the

26   fact that we candidly wrap ourselves in the warm blanket of a lot of our

1   prescriptive deterministic types of approaches of the past.   As a result, the

2   United States has an amazing nuclear power safety record.   So obviously,

3   those efforts were not misguided in every dimension.

4   But that, I'd also note that I think people at NRC are more

5   aware today that the world has not only been changing outside our doors

6   and the nuclear technology, the enterprise, the knowledge base.   It's

7   changing at a pace that is quicker.   Whether or not -- I came here when

8   NRO, the New Reactors Office, just had been stood up.   We were

9   populating that with all kinds of competencies.   We were bringing and hiring

10   a lot of people from the outside.

11   We find ourselves in a different place today due to things

12   that are outside of NRC's control.   But I think that the merger of NRO and

13   NRR is, of course, a product of the fact that we do not, in the United States,

14   have the kind of nuclear renaissance that we were preparing ourselves for.

15   But whatever the cause of that merger, I think that the

16   result is going to be a further strengthening of our core capabilities.   It may

17   be that the reason we're doing it is a changed circumstance outside our

18   doors.   But I think when I hear that we're going to be bringing together

19   experts who worked on digital I&C and new reactors and the experts, their

20   colleagues who worked in a different office in the operating reactor venue.   I

21   think that we're going to have the reinforcing and the multiplier of bringing

22   them together, and there's going to be a lot of positive, synergistic things that

23   will come from that.

24   They're going to get to compare of why did you come at it

25   that way and I came at it this way.   But I think at the end of the day we're

26   going to bring together the experts that we have in these areas.   And I think

1   it's going to just amplify and strengthen our progress on a lot of different

2   things we're working on.

3   And I'm going to maybe pick on Ho on just one thing.   You

4   were mentioning, when do we stop the testing process.   I know you're

5   drinking from a fire hose.   But could I suggest to you that you look at

6   something called GSI-191 which has also been going on for the entire

7   tenancy of my time here.

8   Now, the inspector general is doing a review of our generic

9   issues program.   I suggested that we look at how do we define an issue

10   when we start.   Let's begin with the end in mind.   When will we have settled

11   the question?   If you learn new things along the way, you can always open

12   another generic issue.

13   But we have generic issues in this agency that have

14   decadal time frames.   And I think it doesn't serve us well and it doesn't

15   serve us in terms of the confidence that the American public should have in

16   us if we have a question and we can't answer it in 10, 15, or 20 years.

17   I think it reflects inaccurately that we don't have enough

18   knowledge and confidence about what we're doing.   That's not true.   But it

19   sure is going to look that way when you can't answer a question after all that

20   time.   We can't keep redefining the question along the way or we're going to

21   have these very, very prolonged types of open issues.

22   So I think the GSI-191 digital alliance, a lot of these things

23   are transformative paradigm shift is going to bring I think enhanced progress

24   to a lot of things that we're doing.   And I think once you kind of step back

25   and the culture changes a little bit and people start having a feeling that they

26   have the freedom to step back and look at what they're working on in a new

1   way.   I think that you begin to see that you don't have to keep doing all the

2   steps individually because it just becomes sort of an atmospheric and it

3   helps you on a lot of different things.

4   So again, I know that I even began by talking about what a

5   struggle this digital I&C thing has been for NRC.   But I'd like to just end with

6   a note that we are -- I think maybe we are at a point where the progress is

7   going to not continue to move linearly on digital I&C.   We're going to start

8   having some step change in making progress on issues.   I think that's true

9   with other things we're working on.

10   Dan Dorman's name came out a lot because he ended up

11   hearing about his transformation work.   We will have as soon as next week

12   a Commission meeting on a lot of the transformative ideas that the staff had

13   but other ideas as well.   So we will be taking Dan's name in vain on Monday

14   morning.   So tune in if you care to hear about that.

15   But again, I thank staff for all the work we're doing for the

16   progress that I also see that we're making on any number of topics.   And I

17   think going forward the Commission hopes that its interest in the matter will

18   be helpful.   If there are things that we can do, please be letting us know

19   because I do think that we want to enable your success on this in any way

20   that we can as a Commission.

21   And if there is nothing else from any of my colleagues, with

22   that, we are adjourned.   Thank you.

23   (Whereupon, the above-entitled matter went off the record

24   at 12:42 p.m.)