Group #15: Community of Interest on the Future of Scientific Methodologies

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| --- | --- |
| Date | November 2, 2020 |

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| Participants | |
| Veronica Rodriguez | Debbie Bard |
| Casee - MS | Karin Rodland |
| Todd Munson | Bruce |
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Contents

[1 Day One - November 2, 2020 3](#_Toc55484148)

[1.1 Discussion: Breakout 1 - Define the Scope of the Problem. 3](#_Toc55484149)

[1.2 Discussion: Breakout 2 - Implications of this Problem. 4](#_Toc55484150)

[1.3 Brainstorm: Day 1 Reflections 6](#_Toc55484151)

[2 Day Two - November 5, 2020 6](#_Toc55484152)

[2.1 Brainstorm: Breakout 3 - Signposts 6](#_Toc55484153)

[2.2 Brainstorm: Breakout 4 - Signpost Plausibility 9](#_Toc55484154)

1 Day One - November 2, 2020

1.1 Breakout 1 - Define the Scope of the Problem.

Participants: 3

**Question or instruction for the discussion:**  
Breakout 1 - Define the Scope of the Problem.  
The purpose of this session is to lay the foundation for the next 5 sessions. That is, each breakout group will define a key piece of technology, a new device, or methodology that would have an impact on how the labs/scientists operate. The details should include answers to the questions below.



**Sticky points:**

 Top Takeaways (5 points per participant)

* What is the problem, issue, technology, device, methodology?
  + (2) Carrying capacity of earth (#1)
    - Address through space travel? (#3)
      * would need to interface with NASA (#6)
    - Address through population control? (#4)
    - Carrying capacity and increasing resources available (i.e., Green Revolution Part II) (#5)
      * Part of Global Security? (#11)
      * (1) Food security is relevant here (#8)
        + Should DOE get into developing sustainable food sources? (#21)
  + (2) Climate change (#2)
    - Adapting to climate change versus modifying climate change (#12)
      * Projecting ecosystems at different conditions? (#13)
    - (1) No more fossil fuels / switch to entirely renewable energy sources (#7)
      * Nuclear power as an alternative to fossil fuels (#22)
        + Nuclear safety as DOE legacy mission - how to evolve that to improve acceptance of nuclear power generation (#23)
    - Carbon costs of current green revolution (synthetic fertilizers) (#9)
    - Water security - rising sea levels, availability of fresh water (#15)
      * Drought (#19)
      * "Fossil water" aquafers (#20)
  + (2) How can we enable DOE to focus on long-term problems, as well as maintaining accountability to the public? (#24)
    - eg NIH governance model vs HHS/NSF governance model (#25)
    - Change in DOE mission? (#10)
    - (1) DOE focus on US versus global issues (#16)
      * (1) DOE interfaces with other agencies and partnerships (#18)
      * partnering with other global agencies (#17)
    - Insulate basic research from populous pressure (#26)
    - Silo'd research agencies (#27)
      * mission of funding agencies do not allow for much overlap/collaboration/new directions (#28)
    - Office of Science insulated from political pressures (e.g. NIH) (#39)
    - LOTF (#29)
      * scientists can work on long term goals (#30)
        + scientists collaborate across disciplines (#31)
    - (1) Issue: How to transform DOE to respond to the societal problem? (#42)
  + Need for scientific literacy in society - taxpayer support and political advocacy (#37)
  + (1) Science literacy - what skill set will people need? The general citizen? Policy makers? Future workforce? (#44)
* Who would develop it (basic research to advanced deployment)?
  + The problems we are discussing are big enough that they require collaboration across all/most US agencies, and even global agencies (#35)
  + Addressing this problem would require collaboration among scientists/researchers as well as policy makers with support from the general public. (#47)
* Who would use it and what skills would they need to use it effectively?
  + Society as a whole would use the technologies developed in response to the issues we have identified (#32)
  + Scientific literacy in society (#36)
  + How do we develop the skillsets required to tackle these issues? (#43)
* When would it be expected to be in production use (N years in the future)?
  + We are looking at a 30 year horizon (#45)
  + Implementation will be continuous and evolving over this time frame (#46)
* Where, and how widely, would it be deployed?
  + Society-wide (#38)
  + Global-scale problems require global solutions (#40)
* What is the setup time and/or process for using it?
  + 30 year horizon (#33)
  + The large-scale problems we are discussing fit in the 30-year horizon (#34)

1.2 Breakout 2 - Implications of this Problem.

Participants: 2

**Question or instruction for the discussion:**  
Breakout 2 - Implications of this Problem.  
Each group will now develop a list of issues and implications for the issue/technology/community they settled on. There are lots of implications for how a technology can be used, or further developed.



**Sticky points:**

 Top Takeaways (5 points per participant)

* What other/companion technologies, services, software/hardware must also be developed and deployed?
  + Carrying capacity & climate change (#5)
    - Transition from fossil fuels (#6)
      * Renewables (#7)
      * Nuclear (#8)
    - Space travel? (#9)
    - Water desal (#10)
      * The DOE should be more involved in planning for (and mitigating) future water shortages (#46)
    - Carrying capacity and the climate emergency are perhaps separate problems, but they are linked because they both put a strain on resources (#36)
    - Food production (#37)
      * New means of food production may be needed to support an increasing population (#49)
  + We should consider creating an analogue to the NNSA to coordinate the government's response to the climate emergency and/or population pressure (#34)
    - A lead coordinating agency/entity to evaluate & implement national response? (#35)
  + As society becomes more virtual, how does DOE adapt & respond? (#38)
    - DOE is a very bounded agency, but we see boundaries dissolving in society. We've seen rapid changes in response to Covid, which shows that DOE can change if there's enough pressure to do so. (#39)
  + What will need to happen in computing? (#43)
    - Supporting role rather than driver (#44)
    - More accessibility; more availability to researchers (on demand) (#45)
  + What technologies would help DOE work collaboratively with other agencies? (#50)
    - DOE collaborations work well when well defined (#51)
    - With virtual work, it is becoming easier to work with people around the world (at the expense of local collaborations?) - this will make it easier for DOE scientists to collaborate with other agencies (#52)
  + How can we enable DOE to focus on long-term problems, as well as maintaining accountability to the public? (#11)
    - (removing following comments that were inadvertently copied over) (#-3)
    - . (#3)
      * . (#4)
      * . (#5)
    - . (#12)
    - . (#13)
    - . (#14)
      * . (#15)
    - . (#16)
      * . (#17)
        + . (#18)

. (#29)

* + - . (#26)
* Who is/will develop this companion technology/service?
  + Change in DOE mission needs to be both top-down and bottom-up. (#32)
    - eg formation of NNSA in response to an emergency/security situation could be a model for the change needed (#33)
    - Public & industry pressure to advance new missions, policy makers willing and able to implement change (#56)
  + DOE will need to partner with industry (#40)
    - what will the funding model be? How will DOE (and other agencies) encourage the development of the technologies we will need? (#41)
      * will we need to increase the scope of government to provide the solutions that industry cannot provide (#42)
    - Need to determine the mix: what will be developed by industry, what will be developed by government, what will be developed through partnerships. (#55)
* What skills/knowledge does the end user require?
  + The "end user" is society at large. We will need to increase scientific literacy skills for the general global citizen. (#1)
    - To achieve this goal, we will need to introduce/enhance instruction in logic and probability & statistics. (#2)
    - The general population will need an understanding of risk assessment, management, and mitigation. (#3)
    - People also need the ability to evaluate the validity of an idea; use the scientific method to test a hypothesis and be able to disqualify it as false. (#4)
* What are the training/support requirements?
  + Policy & player alignment; agreement on the problem & approach to solving the problem (#30)
  + Education of policy makers (especially appointed/elected officials) (#31)
  + Enhancing and increasing DOE's public profile as the "big science" agency working on our most pressing challenges (#47)
  + Evaluating DOE workforce & assessing the skills abilities need at the agency level (#48)
  + As we move to a virtual world, how does that impact collaboration? (#53)
    - Easier to interact with people across the country/world, but does that come at the expense of local collaboration? (#54)

1.3 Day 1 Reflections

Participants: 0

**Brainstorm question or instruction:**  
Day 1 Reflections  
This area is for the Moderator to note key discussion points to summarize what was accomplished in Day one. Remember that day one is focused on Identifying a new technology or methodology and identifying the implications and possible consequences of it. The moderator can populate this individually at the end of the day or request input from the group here.



2 Day Two - November 5, 2020

2.1 Breakout 3 - Signposts

**The following participants have not been active:**  
Bruce, fac- Nami Ishihara, Casee - MS

**Brainstorm question or instruction:**  
Breakout 3 - Signposts  
What we are looking for is technology or social trends that would give us clues that we are on the right track. o How would precursor technologies/services be identified? o What are the precursor technologies/services? o Is there a rank order for when specific technologies/services need to be available? o What DOE or Lab policies need to be in place now, in 5 years? o What facilities need to be in place now, in 5 years?



**Sticky points:**

 Top Takeaways (5 points per participant)

* 1. Societal imperatives: How will DOE evolve and interface  
  with other agencies and private partners to tackle societal  
  grand challenges?
  + Comments
  + Reduce red tape (#5)
  + Handle intellectual property challenges (#6)
  + Get DOE offices to talk to each other (maybe too short term) (#7)
  + Reduce political pressure or limit politically-driven research (#8)
  + Working remotely will put pressure on labs to improve retention and workforce development activities. (When it is possible for everyone to work remotely, the labs will have to step up their efforts in these areas.) (#9)
  + Career paths for those that are able and willing to work across agencies. (#10)
  + Allow for leaves of absence or sabbaticals at academic institutions or private companies. Or make it easier. (#11)
  + Joint appointments (Lab & university?) (#12)
  + Changing the mindset of scientist to value these activities. Bring to bear social sciences on this. (#14)
  + Easier access to facilities/DOE resources for researchers (#15)
  + Less silos between agencies. The big issues cannot be solved by a single agency - there needs to be more ability to do R&D on topics that span both DOE and NSF, for example (#24)
  + DOE is a highly bounded agency while boundaries are dissolving in the rest of society; need to adapt to a more collaborative, agile environment (#31)
* 2. The societal grand challenge: Will our planet have the resources to support the needs of the human population in 2050?
  + Comments
  + We will lack resources which will imply things like more migration pressure, etc. (#16)
  + In 5 years, there needs to be a plan for how we will tackle the societal grand challenge - maybe a dedicated office needs to be stood up (akin to how NNSA was set up, but across agencies) (#18)
  + We need to get society to first understand that there is a problem. And second that solving those issues will have short-term requirements (pain) for longer-term benefits. (#29)
  + We should invest in some wacky ideas as well. Mining asteroids, colonization, etc. (#32)
* 4. How can we enable DOE to focus on the long-term problems related to this challenge while maintaining accountability to the public?
  + Comments
  + Change how we communicate with the public. (#17)
  + Make it easier for the public to understand the value and impact of the work. (#19)
  + Cultivate a longer term perspective, while having signposts along the way. (#22)
  + Reduce the dependence of the public on the dopamine hits from getting another like on facebook. (#23)
  + Educate the public to understand basic technical issues? (#26)
  + Long term funding for research on impactful problems. This would need to be established in the next 5 years. (#30)
  + Tenure for distinguished scientists? (#34)
* 20. Perhaps what we could posit as the grand idea is some kind of deeply integrated science agency that serves all of the Country's basic and applied research needs, with a uniform and coordinated prioritization, but with each subagency, NSF, NIH, BER, ASCR, NOAA, EPS biting off different hunks of the question using different styles of investigation. Perhaps we need a Department of Science, with Secretary of Science, who helps the President formulate a coherent R&D policy for the nation, and who is then charged with implementing that vision
* 25. This is the scale of problem that illustrates the need for a highly coordinated response, as it impacts national defense, energy production and allocation, human health, environmental protections, agricultural production and many more. Perhaps we would be more successful if we were more integrated
* 27. To answer the questions:
* 28. 1. need to establish a Cabinet-level Department of Science
* 33. DOE and Lab policies would have to be more open, particularly regarding non-US citizens  
  Remote working would allow a more diverse lab workforce and also facilitate closer interactions with academia and corporate R&D efforts  
  Still need to have some way to bring people together, either in person or virtually, to spark innovation and creativity  
  Also need protections for national security were relevant
* 35. Discussion
  + Comments
  + Societal imperatives discussion: What is the perfect DOE? What is the ideal organization to support scientific research in the country. Lots of implementation ideas, but not big ideas. What about a department of science? Take the relevant parts from the existing agencies and put them into a single cabinet level department to have more higher level integration. With one entity, there is the possibility of constraints with one agency setting the agenda. Multiple agencies mitigates the risk of having blinders on or limiting the agenda. Start from the ideal and then worry about the barriers the next time. For private partnerships, we need to be more willing to talk in the language of business and manage relationships with corporate R&D efforts and conversant with their priorities. Who are the people that will be in DOE? Does the workforce include entrepreneurs. Note that this includes the administration and science. It takes a village with many different skills and interests. Scientists are not necessarily interested in learning how to interact well with businesses. Would an agency like this reduce the siloing and bureaucracy? Certainly this would reduce the siloing and bureaucracy. Improved coordination. Excruciatingly hard to work across agencies right now. If you get the wrong people involved, you can get more siloing and bureaucracy. The program manager can make it more or less effective. A single agency would make it easier to transfer funds. Paperwork currently takes months across agencies. Competition within an agency is just as much a problem of competition across agencies. Change the metrics for which people in the office are evaluated. Make it understand that failures are okay and understanding risk. Accept and manage risks. Speaks to private partners when you have one entity and one set of rules. Too much getting wedded to a particular agency partner. Can be more agile in one agency. How would congress react to a single department of science? Would they feel they have adequate oversight? Labs in remote areas struggle with recruitment and retention is a problem. Allow more remote workforces and sabbaticals. A geographically mobile workforce, especially for entrepreneurial type people. Cultures are very different across the country, including their tolerance to risks. International participants and dealing with security issues could be easier. These problems need international collaboration and not just people within the US. Global effort. The agency would need to be more outward looking. Definitely a hierarchy in agencies with high priorities in state and defense. Department of energy is a second or third tier. Agency profile needs to be raised. Would a department of science be a blockbuster agency or would they want to fly under the radar and hence be more flexible. (#36)
  + More supportive of other agencies, or on an equal footing with the other agencies? Improve the profile of science and make it understandable by the public. Authority is too splintered to elevate it in a comprehensive manner. NASA in 1960 had an audacious goal that the public was excited about. People understood the mission and the challenges. That type of communication is needed to elevate the importance of the science and the agency. Our materials and resources are the people/workforce, which will need to evolve. Diverse workforce in terms of training, skills, passions (translation, basic, business), and all the other characteristics of background, gender, culture, etc. Technology gets back to remote working issues. How to balance needs for security versus openness for an open laboratory system? How do I know my people are actually being productive? What is the right metric of productivity? The number of hours or the product at the end of the day. It takes a village. The idea of research parks with a business or academic partner. Not sure how successful these are. Will there be a need for these or can we achieve these in a remote environment? What about the unique facilities at the lab? Do you need to be on site? Or can you develop the technology to operate it remotely? What new technologies are needed? If we are all remote, does it make sense to have branded laboratories? What makes a laboratory a laboratory? One lab? A national laboratory complex with different sites? Would be less competitive, more integrated. Less competition for flat fees for the operators. Operator effects the culture. Academic operators look more like academic departments, others have more business structure and outlook. Should the labs be operated by the government rather than contractors? Do not always want to control scientists. Separate operations of the site from the management of the science. Take a hard look at the operations model of the national labs. Separate operations from science and technology. Already separate within each lab, but can be duplicative. Easier to change site locations when there is one complex. Different geographic assignments are possible. Coordinated nationally and internationally. Even in operations everyone has their own quirky systems and a national complex could limit those. (#37)
  + Make science intuitive. (#40)
* 38. Signposts discussion
  + Comments
  + Introduces research that is coordinated across multiple fields that would not be possible in individual siloed agencies. Governments endeavors that bridge agencies. Cancer moonshot, for example. Brain initiative. AI office that bridges agencies. New facilities that support science across agencies. High impact publications across agencies. The level of international support we may be able to judge and measure. Covid/Ebola responses can serve as a blueprint for some of these activities and cross fertilization across agencies. Also show how agility can be achieved. Turn this into the standard by which we do science. What can we also learn from these efforts that can be applied in other situations? What is a signpost for how we communicate with the public? Enhance communications; not enough general awareness. May have to do with the culture of secrecy. Need to communicate successes more directly to global society (and/or congress). Need the same level of recognition as NASA or the Space Force and show value to the average person on the street. E.g., biomedical research. Embed communications specialists with the research scientists. Matrix operations model. Operations need to learn how to communicate effectively with scientists and vice versa. (#39)

2.2 Breakout 4 - Signpost Plausibility

**The following participants have not been active:**  
fac- Nami Ishihara, Casee - MS

**Brainstorm question or instruction:**  
Breakout 4 - Signpost Plausibility  
Now that we have the list of signposts, the groups need to consider how plausible they are and what DOE needs to do to either ensure they happen or the implications of them not happening. o Who is actively working on these precursors? o When would these precursor technologies/services be needed? o What active or pending research programs need to be in place now? In 5 years? 10? o What existing or planned facilities need to be in place now? In 5 years? 10? o What software services or capabilities need to be in place now? In 5 years? 10? o How successful has the community been in meeting previous goals?



**Sticky points:**

 Top Takeaways (5 points per participant)

* 1. Current agencies need to agree that there is a problem.
* 2. Congress needs to agree that there is a problem and be willing to push forward a solution.
* 3. The political will to support and implement an agency restructure
* 4. Improved communications strategy is very plausible, with agency buy-in
* 5. The public support for a restructuring.
* 6. Public (and industry) support to push change
  + Comments
  + Industry can be a real driving force for this, lobbying etc (#26)
* 7. Successful demonstration projects so everyone can see the value.
* 8. Understanding and acceptance of the fundamental importance of science
* 9. 1. There are current 'all of government' iniatives to tackle big societally important problems, that involve DOE, DOD, NIH and others (e.g., Cancer Moonshot, BRAIN iniative, COVID response). We need to make these the norm, rather than an exceptional response  
  2. These activities represent a good beginning, should increase every year - may need Congressional action to encourage/facilitate
  + Comments
  + These have been successful, and could be held up as exemplars (#25)
* 10. "Small" projects within the DOE to demonstrate savings and benefits. E.g., common HR system software, rather than individual laboratory systems.
* 11. Increased international support and participation.
* 12. International cooperation requires a massive political and diplomatic effort
* 13. Understanding of the risk of not investing in science to have the capability to respond to emerging challenges
* 14. Make sure the scientists buy into and support the concept and see the value of it.
* 15. Address incompatible incentives in the system that reward individual projects, but not team effort.
* 16. 3. Perhaps the collaborations can be staged around themes: national defense , infectious disease, climate change and food/water security, energy systems  
  then grow the venn diagram over time, and appoint appropriate overseers/program directors to establish a culture of collaboration  
  4. new integrated facilities would help - research parks and branch campuses adjacent to major user facilities like EMSL, beam lines  
  5. Better software to enable remote collaboration (see other groups)  
  Aforementioned examples of collaboration have had short term success, need to come up with sustainable reward system for collaboration
* 17. Coordination of basic IT (and other operations) systems across the complex
* 18. Have the will to follow through with international agreements and not back out of them. Necessary to build trust.
* 19. Need to build trust with the public that this is working and valuable. This ties into the communications as one aspect.
* 20. Global citizens - think in global terms rather country interests
* 21. PLAUSIBILITY  
  biggest impediment to success is probably 'politics as usual' and bureaucratic competition for turf - would any of the existing cabinet departments give up their science arm in order to have an integrated national science agency?  
  Additional barrier is public support for/understanding of the concept - would probably require a general and significant increase in scientific literacy
* 22. Understanding of the threats (to national security, etc.) if we maintain the status quo
* 23. Engage the community in the scientific endeavors? Something like SETI@Home. Helps make the community active participants and partners.
* 24. Disruption is coming; need to have a plan for when opportunities present themselves
* 27. Fund larger research projects using DOE Order 413.3B?
* 28. Discussion
  + Comments
  + Build support. (#30)
  + Think across borders. (#31)
  + Look at existing initiatives and build off of them. (#32)
  + Get the word out. Consistent and effective communications. (#33)
  + Administration changes can hinder progress and communications. (#34)
  + Build support and recognition. Hope it become apolitical. (#35)
  + Accountability. (#36)
  + Private sector partners; public service announcements. (#37)
  + Hard to build support when there is not broad knowledge of what is going on. (#38)
  + Labs need to help out and be part of getting universal buy in. (#39)
  + General pessimism and antipathy. (#40)
  + Scientists trained not to overstate their results. (#41)
  + Lot of jargon. Needs person to move from jargon to communications to the public. (#42)
  + Keep your audience in mind. Congress is different from general public. (#43)
  + People are skeptical of technology. Science for science sake does not have as much support as it did in the past. (#44)
  + Fear of AI and automation and the economic implications. (#45)
  + Science is not "science will solve all problems", but "science will solve some problems and introduce new ones" (#46)
  + Need to also talk about the practical implications. (#47)
  + Proliferation of the science newsletter and public information releases that "we solved cancer" are counterproductive. (#48)
  + Every one tries to draw attention to themselves for funding reasons. Can be leading to distrust. (#49)
  + Evaluating science when there are differences of opinion. (#50)
  + Need for well planned and coordinated communications campaign. (#51)
  + Get science in kids shows. What is the equivalent of Bill Nye these days? What is the equivalent of the "how a bill becomes a law" cartoons? (#52)
  + Use the right medium for communications. These days there are limitless alternatives. (#53)
  + Education on how to evaluate anything. (#54)
  + If it seems too good to be true, it is not true. (#55)
  + How do we do basic science education for people to function successfully in the 21st century environment. (#56)
  + Be more strategic on science education, rather than opportunistic and reactionary. (#57)
  + More emphasis on logic skills and basic probability and statistics. (#58)
  + How to assess your own personal risk? (#59)
  + Needs to see real benefits from this, rather than more competition. (#60)
  + Rethink how things are funded and how the funding model actively supports this. (#61)
  + How will the agency fund this research? (#62)
  + Reduce risk that big will simply vanish and you will be out of a job. (#63)
  + Need a mechanism for the little ideas as well as the big ideas. (#64)
  + How do you balance the research portfolio between these types? Both are very important. (#65)
  + Need exploratory efforts and large team efforts. (#66)
  + Funding seed grants for a group of people (#67)
  + Cross-disciplinary seed projects; LDRD model across labs. (#68)
  + Notion of tenure and a basic level of support for "tenured" scientists. (#69)
  + Need a support structure with some basic level of support. (#70)
  + Need also a mechanism to get rid of deadwood. (#71)
  + If you want scientists to think big, we need to provide them the ability to think big. E.g., 20% time. (#72)
  + These are hard problems, but we need to figure these out. (#73)
  + Encouraging junior scientists and overcoming morale problems when they are not allowed to lead. (#74)
  + Develop appropriate promotion and professional development opportunities to balance benefits of team science with the ability to grow as an individual investigator. (#75)
  + Mid-career LDRD to fund 20% of the time? (#76)
  + How to get congress to value LDRD? (#77)
  + Communicate and show the return on investment of LDRD? (#78)
  + Matter of control and accountability. (#79)
  + LDRD from the agency, rather than the labs. That gives oversight. (#80)
  + NIH system has peer review, but no external peer review of LDRD. (#81)
  + Balance between different types of research activities. (#82)
  + Mix is different depending on the field. (#83)
  + Mechanism to promote coordinated team science and adequately enhance and support smaller pilot projects with a high risk of failure. (#84)
  + Need mechanism to defund projects with a ramp down of old projects and a ramp up of new project. (#85)
  + Need succession planning for projects. (#86)
  + Cannot do good science when you are worried about having a job because there is no succession planning for funding project and individuals. (#87)
  + Share best funding practices for different scientific purposes (e.g., pilot projects versus large collaborations). (#88)
  + NIH has a feedback and resubmission process that DOE lacks. There are benefits to this approach, both for development of staff and to get good projects funded. (#89)
  + Investigator initiated research grant; write a proposal and convince your peers that it is worth funding. Congress people know what is being funded this way. (#90)
  + DOE peer review process is highly dependent on the panel chosen. Multiple opportunities for submission can get a proposal reviewed by different panels. Average out the stochasticity with multiple submissions. (#91)
  + If the agency does these things, then they are along the way to becoming successful. (#92)
* 29. Timing discussion
  + Comments
  + Ease into the creation of a new agency? Or demonstrate the value first? (#93)
  + First, initiate a small cross agency project similar to Covid/Ebola to demonstrate the value and feasibility. (#94)
  + Maybe something around water of food security. (#95)
  + Or around predicting and responding to extreme weather events. (#96)
  + Major restructuring does not come about in reality unless there is a triggering event. We will have to do progressive work to prepare for the major disruptive event that will require a fast, big response. (#97)
  + Be assessing the gaps due to having different agencies. (#98)
  + The disruptive event would require scientific coordination and restructuring. (#99)
  + Build awareness around the barriers and what would happen without the barriers. (#100)
  + A. Continuing support for existing collaborations (#101)
  + B. Better communications about accomplishments to team science. (#102)
  + C. Working with congress to provide incentives for new themed interagency projects. (#103)
  + D. Working on infrastructure for a single integrated agency. (#104)
  + Between A and B is workforce development. (#105)