

## 2020 US FOE – Next Grand Challenges Breakout Session Results

### Floor 1, Table 1

Provide access to clean water  
Mitigate climate change and adaptation  
Protect and improve global health

### Floor 1, Table 2

Improving human interaction with algorithms and robots  
Improving cognitive security/combatting misinformation, deep fakes  
Restore and improve urban infrastructure

### Floor 1, Table 4

--Climate change – Countered by carbon sequestration methods; reversals on current practices required; solutions heavily science/engineering driven, sea level rise, extreme weather events  
--Preventing nuclear terror – existential; other avenues (diplomatic, political) aside from engineering that can help  
--Preventative healthcare – to counter pandemics/outbreaks, “virus X,” antibiotic resistance  
Engineering solutions = diagnostics, infrastructure and ventilation, medicines

### Floor 1, Table 5

#### *Short term (1-5 years):*

Engineer better medicine/Advance Health Informatics. We feel like this is one item now – advance human health protection with advanced meds and information (informatics is much more advanced beyond 2008 now)

Advance personalized learning. This is really important now in light of the pandemic. And access to learning that makes sense for everyone.

Engineer the tools of scientific discovery/ Materials discovery with AI and fabrication. We reached a bit of an impasse here. Some people thought these were related and others thought they were separate. The materials is a new item and new tools are still important. New tools do relate to developing new materials. It could be nested under “tools” or separate.

#### *Longer term (5-10 years):*

Develop carbon sequestration methods/ Add other pollutants, plastic and upstream prevention/Provide access to clean water. We feel these three are really now one: prevent and remediate pollution, which gives us clean water, sequesters carbon, and prevents plastic and other pollution (and cleans it up).

Resilience of infrastructure/Secure cyberspace. We see this as one since cyber is also a part of our infrastructure, so improve all infrastructure – both urban and rural – in a way that keeps it secure.

Prevent nuclear terror/Provide energy from fusion. We had discussion about protection from nuclear warfare, but then about protecting the nuclear power plants from cyber and catastrophic events, so we ended up saying this was one thing in terms of prevent terror and protect safe use.

### Floor 1, Table 6

Reverse engineer the brain  
Engineer better medicines  
Develop carbon sequestration methods

### Floor 1, Table 7

New Category: Engineering human behavior, i.e. what technological innovations (apps, systems, etc.) can be used to positively influence human behavior and habits, like “buying in” to the idea of changing ingrained habits like waste reduction (i.e. stop using plastic), or using less energy, reducing fossil fuel use. We initially wanted to put one of the energy/carbon sequestration technologies earlier, but thought that by far changing human behavior would be way more effective than developing other technologies that would act as a “bandaid” (i.e. we need renewable energy, but if it becomes cheaper, people will use more. How do we influence people to act against their own self-interests/make sacrifices for the greater good. Is there technology that can facilitate that?). This also extends to the end of category 3, in getting people to believe in data, and applying it to everyday life. We also thought that the “reverse engineering the brain” could correspond with this category, in terms of potentially extension toward human psychology/impacting behavior.

Prevent nuclear terror – Change to Achieve nuclear security which includes preventing nuclear terror but also controlling/managing nuclear waste and improving safety around nuclear processes and warfare.

Secure cyberspace – Change to securing access to reliable information/ combating misinformation and fake news. Another issue was access to data; where to go for trusted source of information; getting people to believe that information.

Advance health informatics and engineer better medicines – Very important in long term, especially with tailored medicine (and expanding diversity in clinical trials); noted that solutions only occur when pressing/ big needs; there's diseases out there that kill way more people than covid; what if can focus our efforts on those? –heart disease, lung cancer, etc. through better incentives.

Enhance virtual reality – Very covid relevant; how do we keep gains in using zoom and other features but make people invested in them, i.e. it will likely take more realistic virtual interactions to make people buy into this in the long term; making communication more “real” and efficient is especially important during covid and beyond.

Engineer the tools for scientific discovery – Too broad to be able to assess well, but we noted that this category could really fix all, i.e. technologies like crispr to solve major challenges; Hubble telescope, etc.

### Floor 2, Table 1

Elevate storytelling to an engineering discipline. Manage societal misinformation  
Sustainable energy. Waste cycling, availability, and renewable sources  
Foster a balanced and healthy ecosystem. Draw inspiration from natural systems.  
Winning topics: Information/communications; ecosystems/waste recycling; energy

Floor 2, Table 2

Engineering-Society Nexus (societal acceptance as important as engineering)

Preparing for future biological threats (flexible medicine/vaccine discovery) Machine learning?

Removing boundaries between systems (infrastructure, food, social etc. to create meta-systems better than the sum of their parts)

Floor 2, Table 3

Education

Sustainability of materials and systems

Decarbonizing our world

Floor 2, Table 4

Value alignment between engineering solutions and societal acceptance

Food and water security with regard to environmental impacts

Engineer equitable health (existing infrastructure and access)

Floor 2, Table 5

Resilient technologies in response to a changing climate and biosphere

Exoplanet exploration and on-demand and onsite manufacturing in space

Re-envisioning a low-waste future through resource recovery and re-utilization

Floor 2, Table 7

Equitable and personalized health innovation

Engineering and innovation of renewable energy, especially storage

Provide access to clean water

Technological equity and inclusion