Crisis Innovation Policy from World War II to COVID-19

Biosecurity R&D: Lessons from the U.S. from pre-Covid to post-Covid

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We Can Do It!

Office of Scientific Research & Development (OSRD)

- Wartime R&D agency, led by Vannevar Bush
  - Core mission: to support R&D in technologies and medical treatments to further national defense. But also:
  - Coordinate the research efforts of other agencies
  - Manage the mobilization of U.S. science

- An unprecedented experiment in crisis innovation policy—and in large-scale government funding of research
  - >2000 contracts with firms and universities, >$7.5B (2020 dollars)

What’s distinctive about a crisis?

- “The need for speed hung like a sword over the head...”

  -- Irvin Stewart, Secretary of OSRD, 1948

- Conant: “The basic problem of mobilizing science during World War II was [one] of setting up ***rapidly*** an organization … which would <u>connect effectively</u> the **laboratory**, the **pilot plant**, and the **factory** with each other and the **battlefront**”

Features of the OSRD model

- Applied focus, top-down priority-setting

  Demand driven. Broad portfolio. Coordinated. Take basic science as given.

- Engaged top R&D performers

  Prioritized speed, quality. Less emphasis on distributional considerations, cost.

- Attentive to contractor incentives

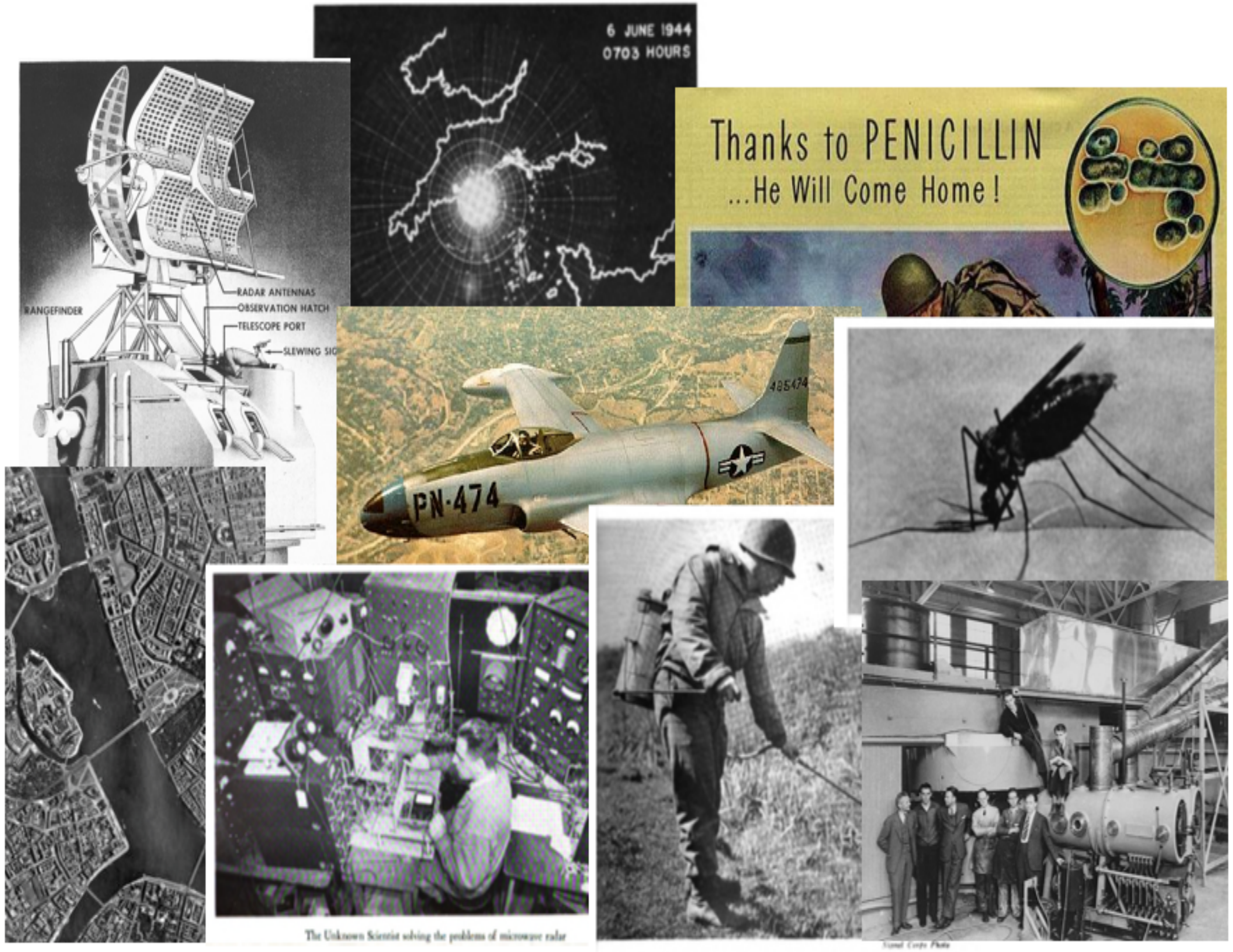
  Organizationally innovative: patent policy, indirect costs, contract mechanism.

- Coordination of research efforts

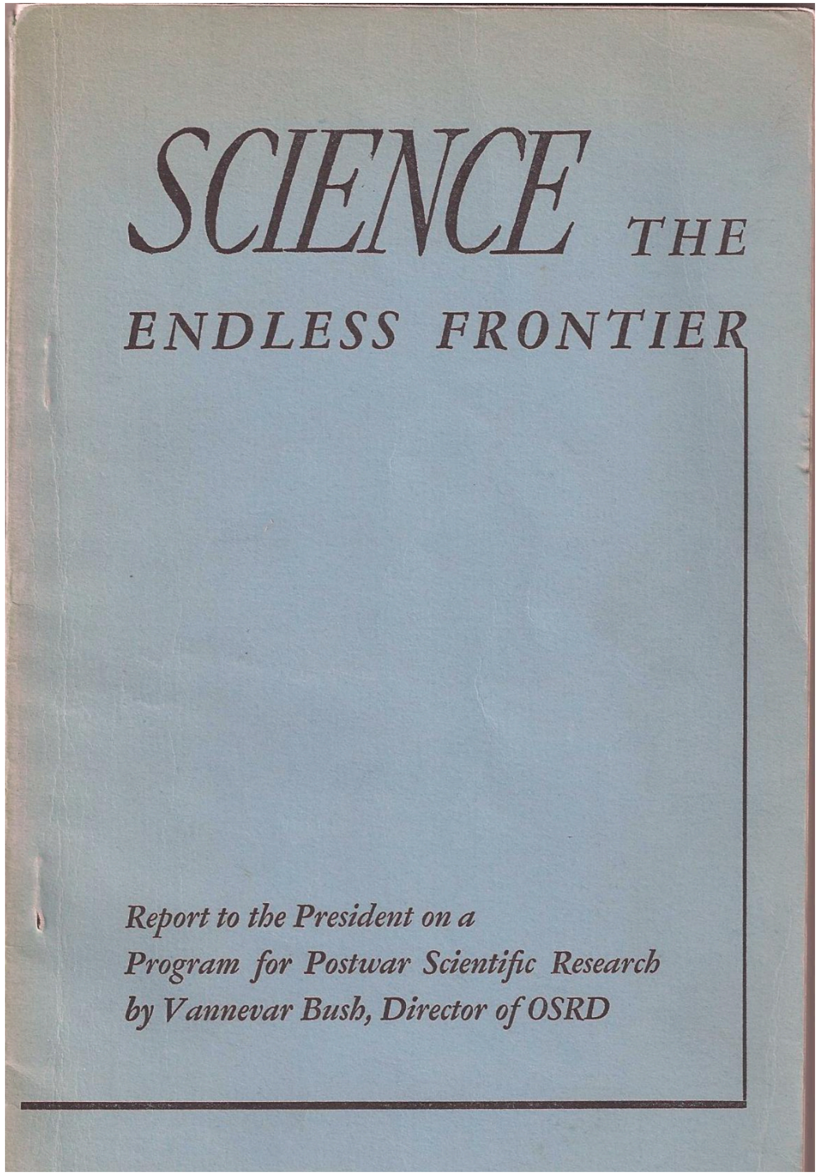
  Across portfolio, with military, other agencies, Allied research

- Investment in production and diffusion

  End-to-end, from bench to battlefield. Capacity at risk. Field activities.



6 JUNE 1944
0703 HOURS
Thanks to PENICILLIN
...He Will Come Home!
RADAR ANTENNAS
OBSERVATION HATCH
TELESCOPE PORT
RANGEFINDER
PN-474
The Unknown Scientist solving the problems of microwave radar



SCIENCE THE
ENDLESS FRONTIER
Report to the President on a
Program for Postwar Scientific Research
by Vannevar Bush, Director of OSRD

The evolution of the U.S. postwar innovation system: 75 years in one slide

- Expansion of federally-funded R&D (FY2019 budget 50x that of OSRD)
  - Across numerous agencies (DOD, NIH, AEC; NSF as “puny partner”), with different priority-setting mechanisms, funding models
- The rise of U.S. research universities
- In medicine, NIH creates an extramural program based on CMR contracts, and becomes the “crown jewel” of federal science funding
  - Investigator-initiated, “basic” research; peer review
  - Some tensions historically about how responsive it can be to applied problems (e.g. War on Cancer, Artificial Heart program)
- NIH “push” complemented by the rise of a sophisticated pharmaceutical industry
  - Also with roots in World War II
  - Responsible for applied activities including trials, manufacturing, marketing, diffusion
  - Patents the main “pull” instrument

Covid-19 response: what research was needed?

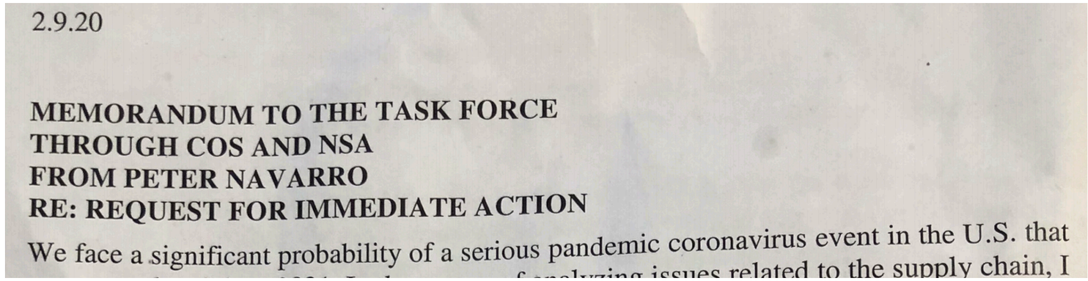
- Vaccines and therapeutics
- Non-pharmacological treatments
- (Rapid) diagnostic tests
- Contact tracing technology
- Mitigation technologies
- Science for policy: Evidence to inform decision-making

High social value: Losses of ~$10 billion in global GDP daily

Covid-19 response: what research was *funded*?

Data from BARDA, NIH, NSF. Weighted by contract/grant value.

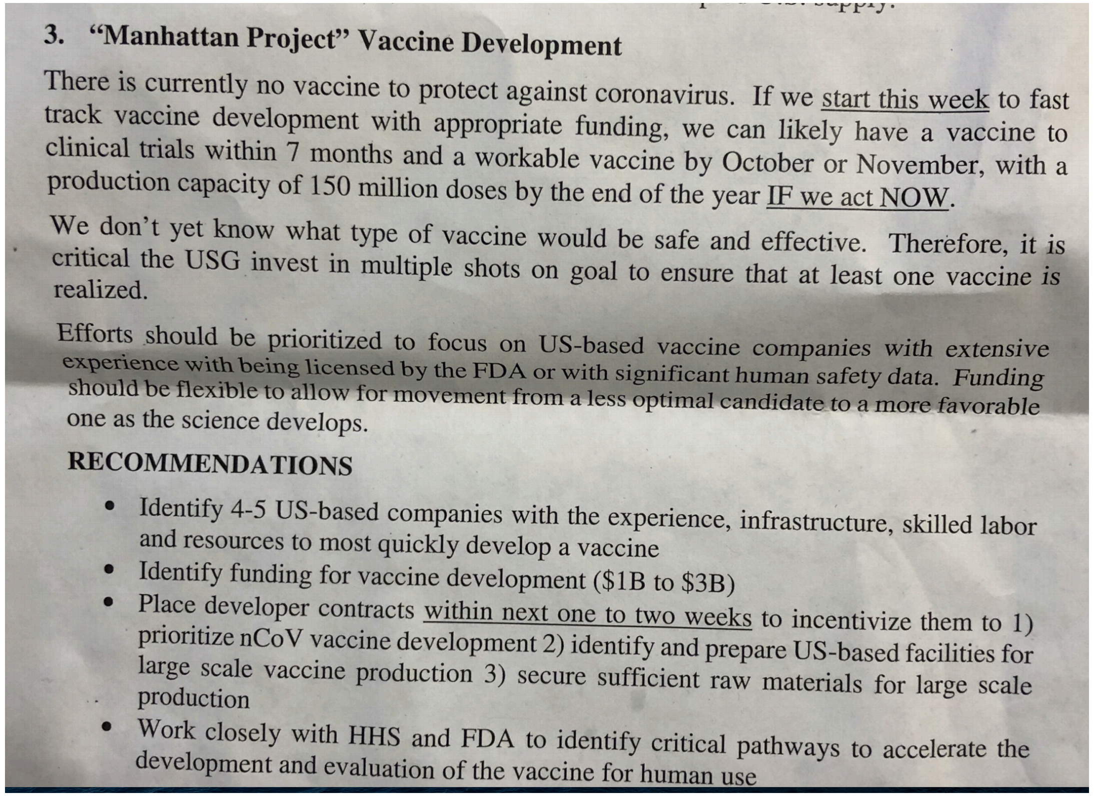
NIH, Warp Speed and the rise of BARDA



2.9.20

MEMORANDUM TO THE TASK FORCE
THROUGH COS AND NSA
FROM PETER NAVARRO
RE: REQUEST FOR IMMEDIATE ACTION

We face a significant probability of a serious pandemic coronavirus event in the U.S. that ... issues related to the supply chain, I



3. "Manhattan Project" Vaccine Development

There is currently no vaccine to protect against coronavirus. If we start this week to fast track vaccine development with appropriate funding, we can likely have a vaccine to clinical trials within 7 months and a workable vaccine by October or November, with a production capacity of 150 million doses by the end of the year IF we act NOW.

We don't yet know what type of vaccine would be safe and effective. Therefore, it is critical the USG invest in multiple shots on goal to ensure that at least one vaccine is realized.

Efforts should be prioritized to focus on US-based vaccine companies with extensive experience with being licensed by the FDA or with significant human safety data. Funding should be flexible to allow for movement from a less optimal candidate to a more favorable one as the science develops.

RECOMMENDATIONS

- Identify 4-5 US-based companies with the experience, infrastructure, skilled labor and resources to most quickly develop a vaccine
- Identify funding for vaccine development ($1B to $3B)
- Place developer contracts within next one to two weeks to incentivize them to 1) prioritize nCoV vaccine development 2) identify and prepare US-based facilities for large scale vaccine production 3) secure sufficient raw materials for large scale production
- Work closely with HHS and FDA to identify critical pathways to accelerate the development and evaluation of the vaccine for human use

- March-April 2020: **NIH** in the lead
- May 2020 on: **Operation Warp Speed**
- Most funding not through NIH but BARDA ($4 billion vs $26 billion)
- Heavy focus on vaccines (~75 percent), but also funds therapies, supply chain
- Focus on advancing vaccine candidates with a good chance of entering trials by end of 2020, and potential to be manufactured at scale quickly (Slaoui and Hepburn 2020)

Covid-19 vs. World War II: Similarities

- Similarities in some of the **investment approaches**
  - e.g.: speed vs. cost, applied focus, parallel R&D, manufacturing at risk
- Relied heavily on **“new” agencies** in implementation (OSRD, BARDA)
- Drew on **pre-crisis stock of basic knowledge** (radar, penicillin, mRNA) and scientific capabilities (universities, firms)
- Faced **similar tradeoffs** (patent policy, managing disruptions)

Covid-19 vs. World War II: Differences

- Warp Speed was explicitly **“America first”**
  - Limited collaboration/coordination between USG effort and “allied” researchers

- Beyond vaccines, **limited government coordination** of Covid-19 research
  - Lack of effective priority setting around key questions of interest, attempts to identify main holes and redundancies in research efforts, consolidation of information

- Broad, **decentralized pivoting to Covid-19** by firms, academics worldwide

- World War II research effort had one major user informing priorities (military), providing feedback, and driving implementation and diffusion

Policy tradeoffs for crisis R&D

- Top-down vs. bottom-up approaches to priority-setting
  - Who has better knowledge on what the important problems are? Feasibility? Implementation challenges? Concurrent efforts?

- Concentrated vs. distributed funding
  - Who has the R&D capabilities? How divisible is the problem? How easy to screen results?

- Patent policy for innovation and diffusion
  - Which is the greater obstacle: incentives for innovation, or broad access?

- Managing disruptions to the innovation system
  - Urgency implies the acceptable degree of interruption to business-as-usual

Long-run impacts of the OSRD effort

- Anecdotally: opened up entire new fields of research

  "The shift in emphasis and even in direction was enormous. Many subjects of minor importance in peacetime become of controlling importance in war. Some subjects are born of war." (Stewart 1948)

- Lasting effects on direction of U.S. innovation, growth of technology hubs
  - We anticipate similar effects in biomedical research (work in progress)
- Deepening of R&D capabilities in firms and universities involved in war effort
- Foundation for peacetime S&T policy, from STEF to Cold War defense R&D

Looking ahead: Insights for the post-Covid era

- Preparing for the next crisis: lessons in crisis R&D management

- Existing stock of fundamental knowledge + scientific capabilities (firms, institutions, trained scientists) are a crucial resource in a crisis

- New technological opportunities may follow
  - Currently: enthusiasm around mRNA vaccine development approaches
  - Changes in collaboration, dissemination, open access

- Potential changes to federal S&T policy on the horizon
  - More applied/use-driven research funding
  - Investments in institutional flexibility: ability to pivot to new problems