



Strategic Foresight

Translating emerging science, technology,
and risks to inform decisions

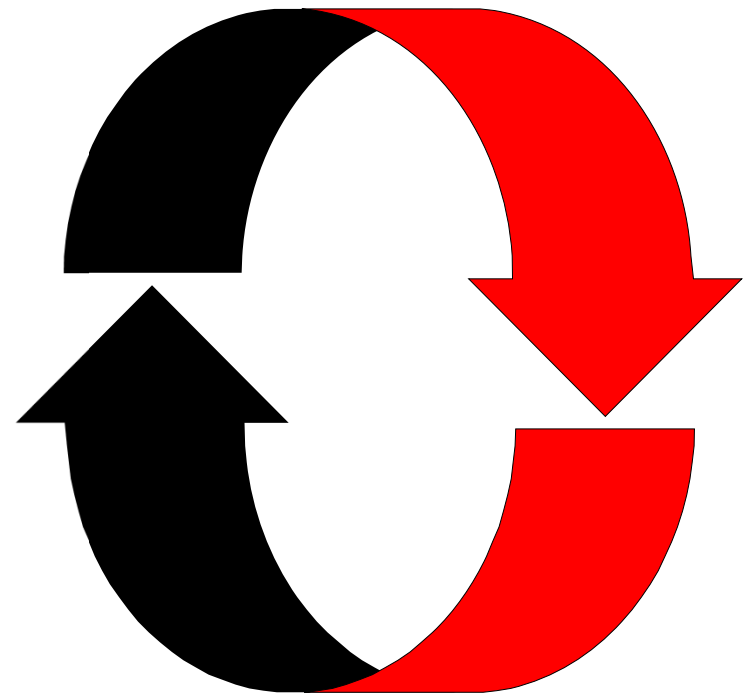
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Why think about the future?

Your view of the future affects your perceptions and goals,

... which affect your actions today

... and your actions today shape your future.



The Illusion of Certainty

“I think there is a world market for maybe five computers.”

Thomas Watson, Chairman, IBM, 1943

“Computers in the future may weigh no more than 1.5 tons.”

Popular Mechanics, 1949

“But what... is it [the microchip] good for?”

IBM Advanced Computing Systems Division, 1968

“There is no reason why anyone would want a computer in their home.”

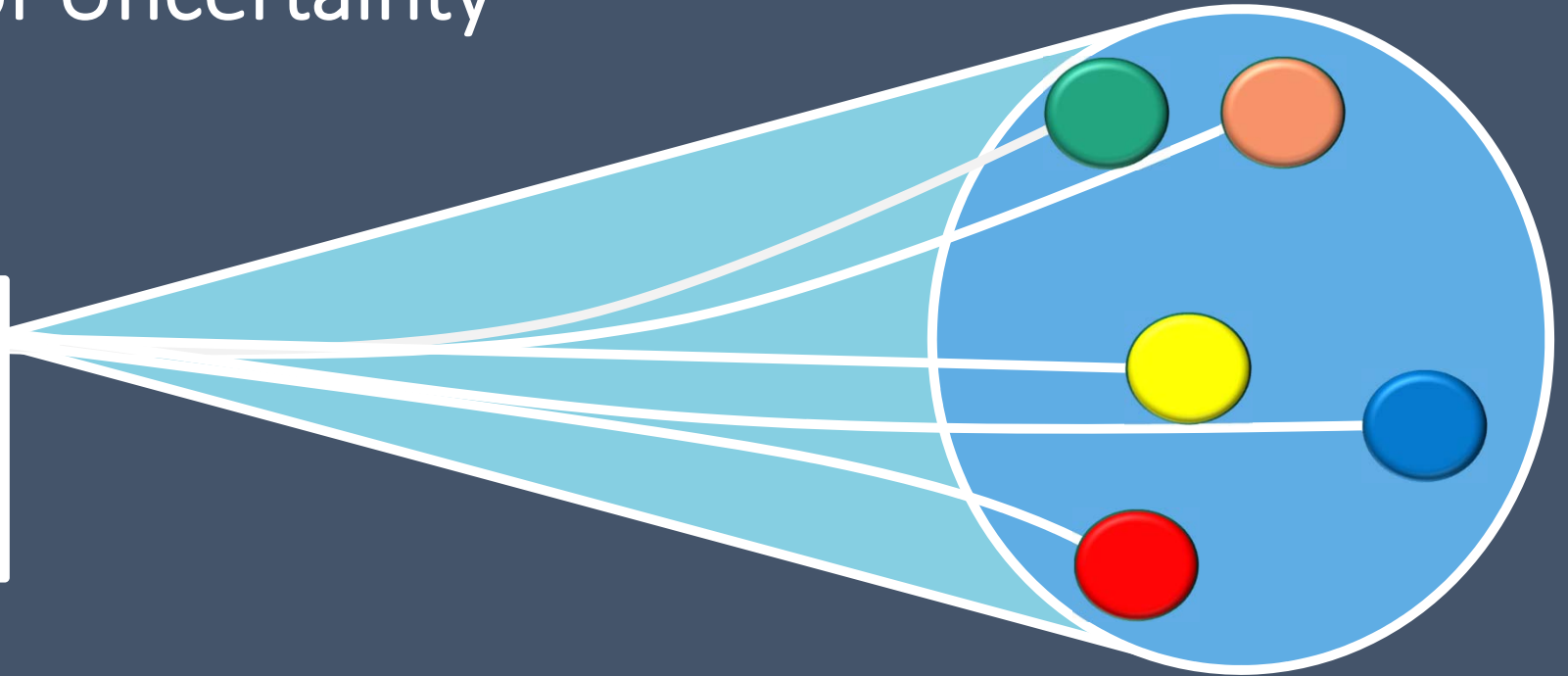
Ken Olson, Founder, Digital Equipment Corp, 1977

“640k ought to be enough for anyone.”

Bill Gates, President, Microsoft, 1981



Cone of Uncertainty



Present

Multiple Futures

Accuracy of Technology Forecast: SSTs

Characteristic	Prediction	Actual (Concorde)	Percent Accuracy
Country	USA	UK-France	0%
First Commercial Flight	1972-1973	1976	97%
Weight	700000	173500	25%
Length	300	200	67%
Engine thrust (lbf)	60000	32,000-38,050	63%
Cruising speed (mph)	1800	1334	74%
Unit cost	\$30-35M	\$33.8M	100%

- By 1975: SST will force conventional jets out of first-class travel on over 1,500 miles.
- By mid-1970's: SST will make intercontinental travel more commonplace for executives than New York-to-Chicago flights today.

(Quinn, Harvard Business Review, 1967)

SST Timeline

- 1976: RT London-NYC Ticket: ~\$4,100 (~\$18,500 today)
- 1979: SST Production stopped.
- By 1981: 700,000 passengers.
- 1981-1982: UK Commons Industry and Trade Committee reported unfavorable cost figures (costs £64M/receipts £23M).
- 1990s: Signs of aging (rudders, wing cracks, windows).
- 2000: Air France Concorde crashes killing all 109 aboard. Air worthiness suspended.
- 2003: Last commercial flight Low passenger numbers following July 2000 crash.
 - Sir George Edward dies (age 94).
 - Slump in air travel following 9/11 .
 - Rising maintenance costs.
 - Airlines could actually make more revenue carrying first class passengers sub-sonically.





Environmental Foresight

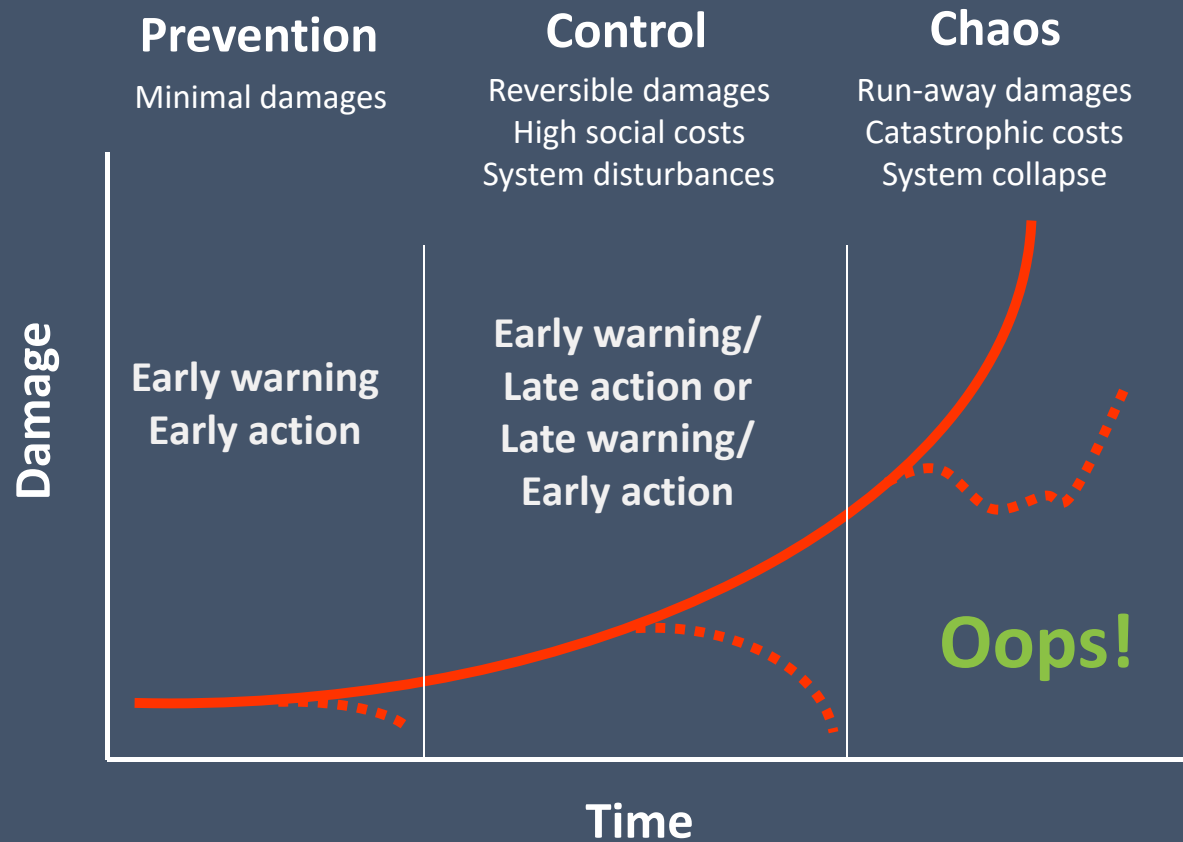
- Inquiry designed to identify potential and emerging environmental issues.
 - Makes possible early responses to emerging threats.
 - Identifies emerging opportunities.
- A management competency

Key Foresight Tools

- **Scanning** – identifying trends, emerging developments, important potential drivers of change, key uncertainties
- **Forecasting** – future estimates of key variables
- **Scenarios** – stories of “what could be” that highlight uncertainties and alternative forecasts, make assumptions and mental models explicit, consider the unconsidered but plausible (both negative & visionary), stimulate imagination
- **Normative Forecasting and Backcasting** – images of the preferred future to clarify aspirations and near-term decisions to achieve them

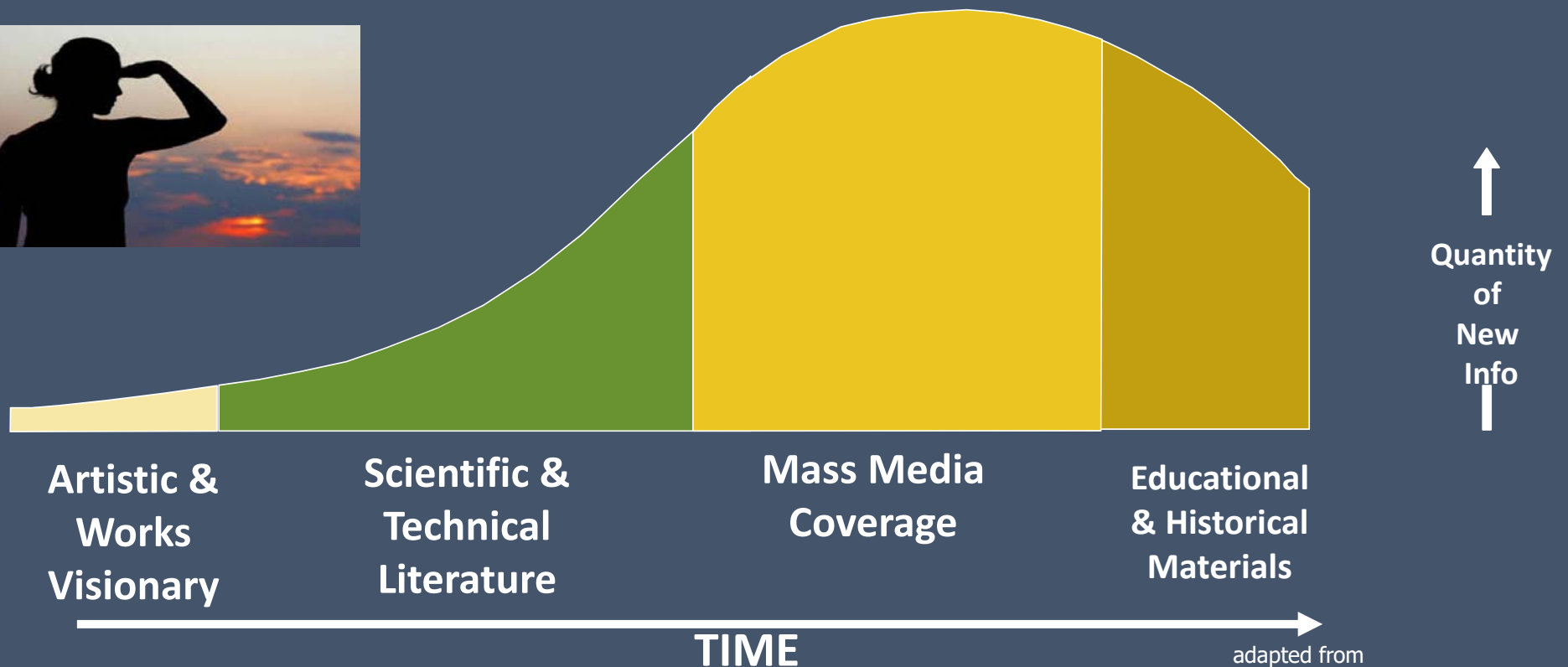


Watch for Emerging Problems – And Deal with Them Early



Horizon Scanning

Search for Emerging Developments



adapted from
Graham Molitor

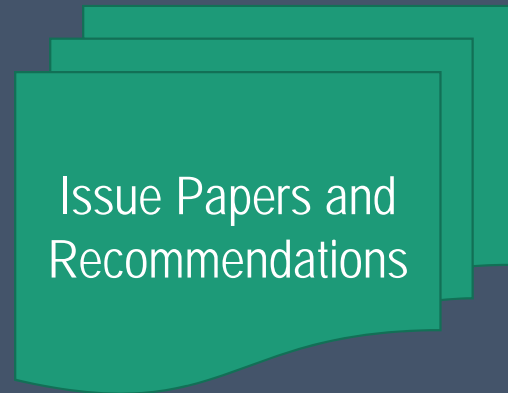
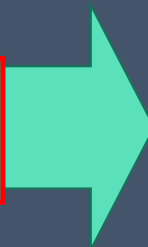
EPA 2016 Lookout Panel Project



Agency Engagement

- Evaluation Criteria**
- Relevancy
 - Feasibility
 - Scope
 - Severity/Impact
 - Probability
 - Timing
 - Novelty
 - Visibility
 - Actionable

8 Priority Issue Areas



8 Emerging Issue Areas

1. **EPA at 50:** scientific workforce, behavioral sciences, communication, & IT.*
2. **Rapid Sea Level Rise:** uncertainty in rate & magnitude.*
3. **Biotechnology:** gene editing (CRISPR Cas 9)*
4. **Data:** explosion in amount & sources of data & information technology.*
5. **Environmental Sensors & Monitoring:** technology and systems.*
6. **Pollution Management:** innovative technology & translational science.*
7. **Supply Chains:** increasingly diverse & global supply chains.
8. **Design for Sustainability:** biomimicry & biophilic design.



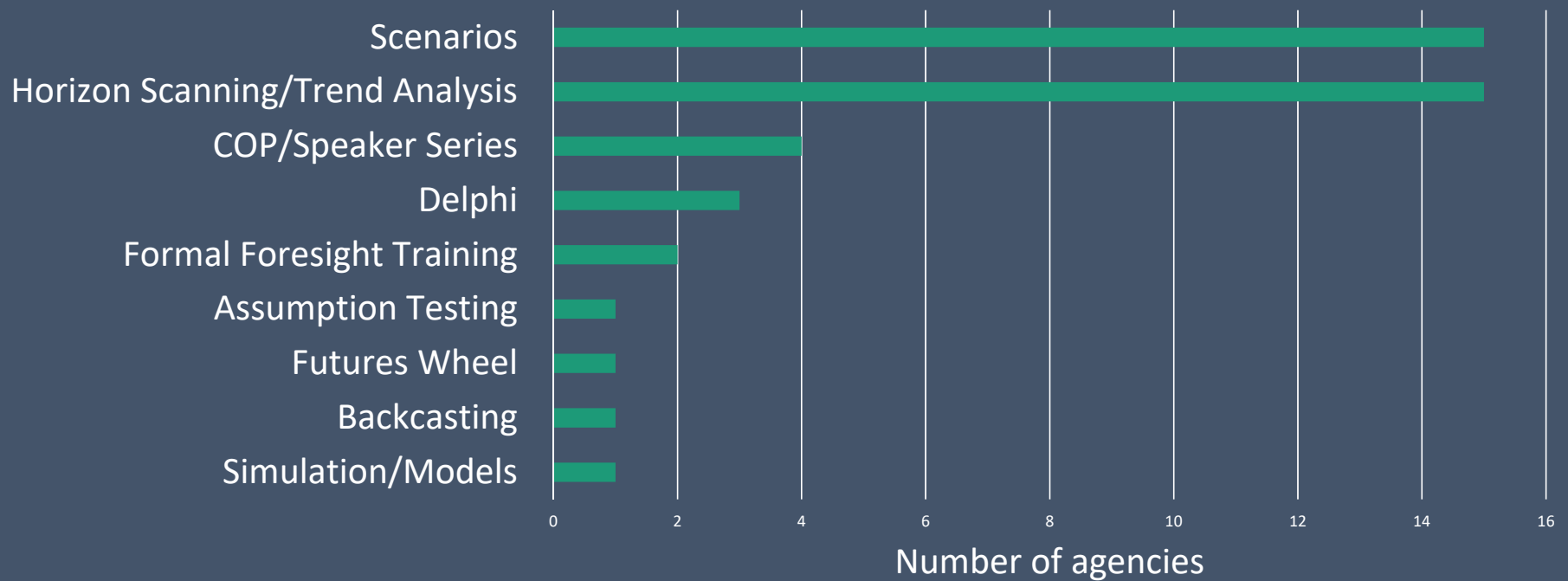
Federal Foresight Benchmarking Project

- Reviewed literature on strategic foresight
- Conducted semi-structured interviews with 19 Federal defense, intelligence, and civilian agencies and 2 foresight experts
- Validated with participants:
 - 1-3 page interview summaries
 - Draft Report
- EPA review and clearance
- Peer review and publication in *World Futures Review*

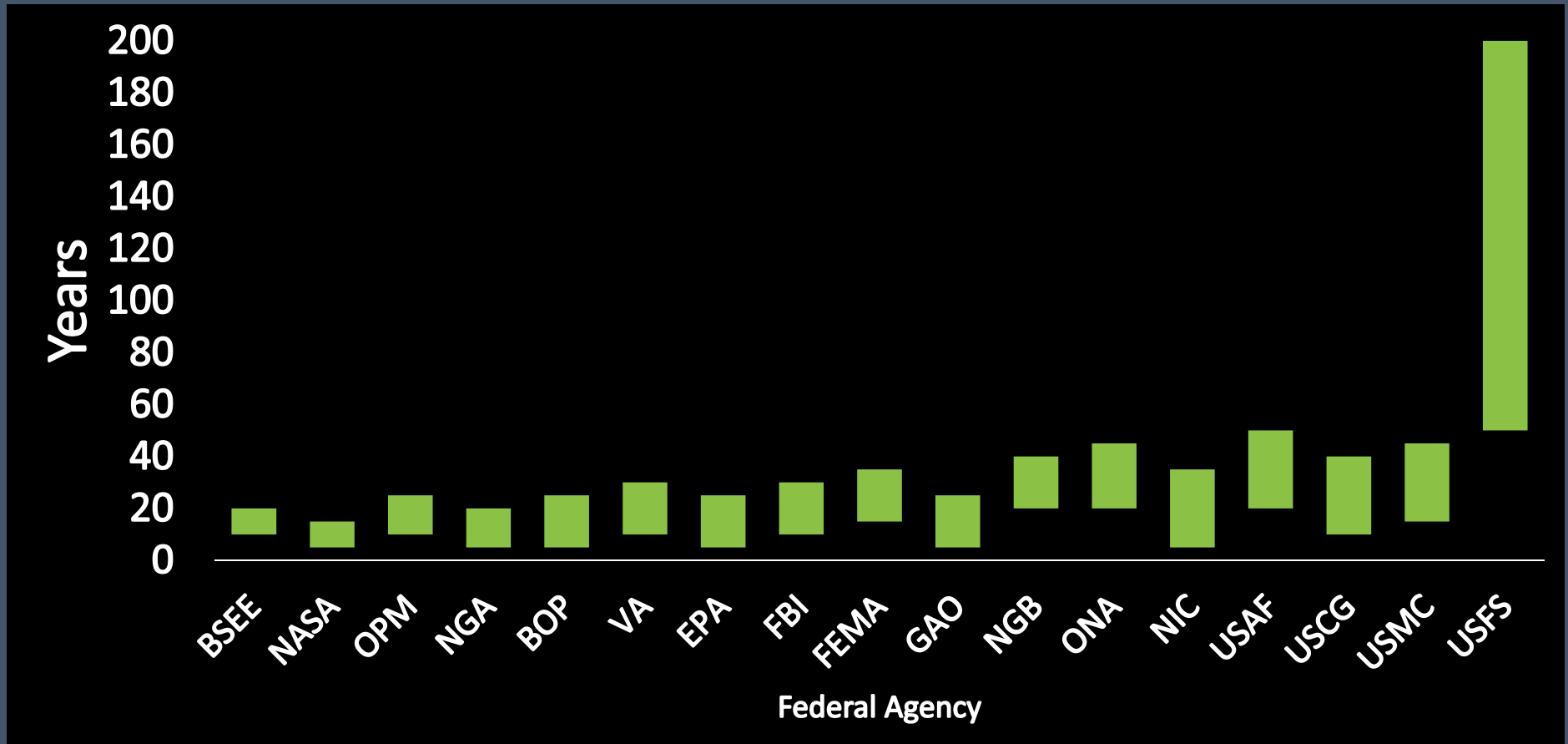
Dedicated Funding

	Extramural Funding			
	Median	Minimum	Maximum	Number of Agencies Reporting
Civilian	\$50,000	\$0	\$750,000	9
Defense-Intelligence	\$1,590,000	\$500,000	\$20,000,000	4
Overall	\$225,000			13

Methods Used by Federal Agencies



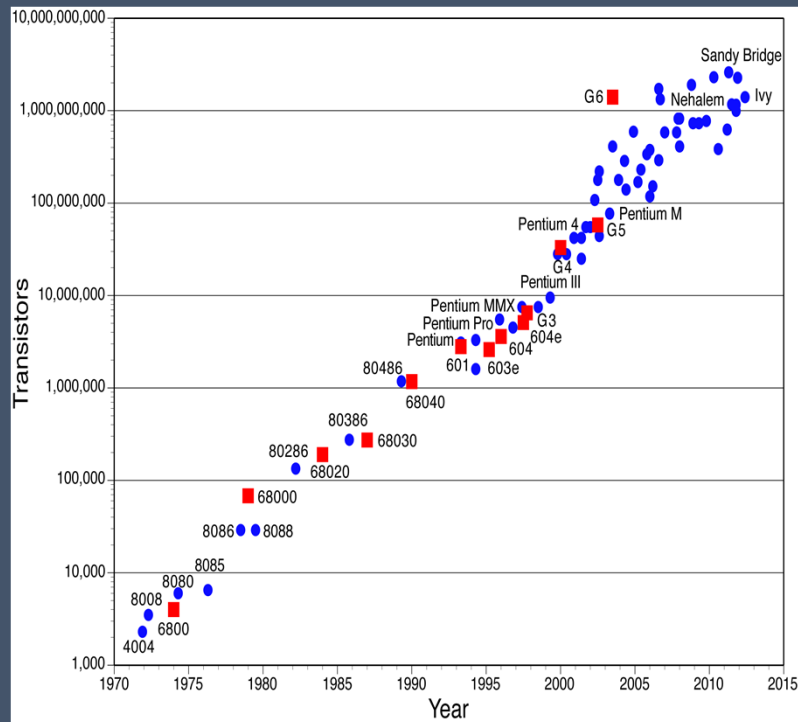
Forward-Looking Timeframes



Challenges to using foresight

- Capacity and resources.
- Policy makers' short-term goals, political imperatives, pressures to crisis manage.
- Position anchoring and investment, cognitive dissonance, and resistance.
- Location of foresight units.
- Coordination, span of control, responsibility, or authority.
- Issue complexity; abrupt and discontinuous change.
- Demonstrating impact.

Cellphone



Moore's Law: The logic density of silicon integrated circuits doubles every 18 months
Storage = 1.5X's Moore's Law
Bandwidth = 2X's Moore's Law

Convergence

- Micro-Electro-Mechanical Systems (MEMS) Sensors
- Battery technology (Li-Air)
- Citizen science
- Ground-based sensor networks
- Meteorological information
- Remotely sensed and UAV-based technology
- AI/Machine learning



Thoughts?

- How do you see these (and other) technologies coming together?
- Over what timeframe?
- How will they impact your business or organization, the environment, the economy, policy, laws, society, and politics?
- What should be the roles of government, industry, academia, nongovernmental organization in technology development, deployment, and use?
- Where are there opportunities for cooperation/collaboration?
- How will this knowledge inform your personal, professional, and organizational decisions in the present?

Resources and Reference

Federal Foresight Community of Interest: <https://www.ffcoi.org/>

Public Sector Foresight Network: <https://altfutures.org/public-sector-foresight-network/>

Strategic Foresight in the Federal Government: A Survey of Methods, Resources, and Institutional Arrangements (2019). Greenblott, J. M., O'Farrell, T., Olson, R., & Burchard, B. (2019). *World Futures Review*, 11(3), 245–266. <https://doi.org/10.1177/1946756718814908>

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