



# Report Summary

# NASA TECHNOSIGNATURES WORKSHOP



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#technosigs18

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<https://www.hou.usra.edu/meetings/technosignatures2018/>

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## Workshop Goals



1. **Define the current state of the technosignature field.** What experiments have occurred? What is the state-of-the-art for technosignature detection? What limits do we currently have on technosignatures?
2. **Understand the advances coming near-term in the technosignature field.** What assets are in place that can be applied to the search for technosignatures? What planned and funded projects will advance the state-of-the-art in future years, and what is the nature of that advancement?
3. **Understand the future potential of the technosignature field.** What new surveys, new instruments, technology development, new data-mining algorithms, new theory and modeling, etc., would be important for future advances in the field?
4. **Understand what role NASA partnerships** with the private sector and philanthropic organizations can play in advancing our understanding of the technosignatures field.

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## Basics



- Technosignature Definition
- Axes of Merit
- Interdisciplinarity of the Field
- **Maturity of the Field**
  - *“... to a large extent, getting good answers to the questions posed by the workshop is not a matter of asking the appropriate experts to synthesize information that already exists, it will require training and supporting scientists to do the work necessary to generate that information in the first place.”*



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## Upper Limits



- **Rigorous upper limits are difficult** due to
  - Different detection algorithms and thresholds used by different teams
  - Follow-up detections, or lack thereof
  - Non-Reporting of null results
- **Estimates made** in (see report):
  - Continuous Wave Radio Searches (Cosmic Haystack: v. small search area completed)
  - Pulsed Radio Searches (Lazio)
  - Optical/Near IR Laser Searches (Howard)
  - Waste Heat and Stellar Obscuration (Wright)
  - Solar System Technologies ('Oumuamua)

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## State of the Art



- **Radio Technosignatures:** “commensal observing” due to lack of funding and telescope time; also SETI@home
  - Existing telescopes and arrays, analysis methods, hardware
- **Optical/NIR Laser Technosignatures:** Existing projects
- **Algorithms and Search Strategies**
  - Need broadest set of search parameters and longevity to get to several 100 light years
- **Searches for Astrophysical Exotica:** machine learning can help
- *“Because funding for searches for technosignatures is so scarce, many searches are done on a “spare time” basis, and so do not have a formal structure or timeline for completion.”*

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## Near-Term



- Technosignature field **spans all wavelengths and non-EM communication**, but today most searches focus on radio and optical
  - *“... the astronomical community possess a wealth of current facilities, which if used for unique observations or for shared data/commensal operation, would greatly expand the technosignature field.”*
- Capabilities at **Radio, Millimeter and Sub-Millimeter** Wavelengths (ground)
- Capabilities at **Ultraviolet, Optical, and Infrared** Wavelengths (ground and space)
- **Solar System** Artifacts and Interlopers
- Developing a **Target List** for Searches
- **Potential Industry/Private Sector Partnering**: data storage and access, signal/data processing, and data analysis tools

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## Future



- Understanding technosignatures **from theoretical prospects**
  - *“What are the likely characteristics of very long-lived planetary societies, and of planets that have been modified by long-term co-evolution of technology with planetary physical and biogeochemical cycles?”*
  - *“...schema of ‘what can’t be avoided/what can be detected’ can help guide new avenues of research in technosignatures, especially in the exoplanet era.”*
- **Communication Technosignatures** (AI, Atmospheric, Megastructures, Heat, Constraints from Complexity, Climates, Geoengineering, Time Evolution, Non-Human communication, Anthropology, Neuroscience, etc)
- Instead of just commensal observations, the field **needs dedicated surveys and instruments** designed to detect technosignatures (specific examples in report)
- Ways to **Catalyze Significant Advances** (private partnerships, academic partnerships, other federal programs)



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## NASA Implications

- ⊙ Positive changes due to Workshop Report
  - E.3 XRP (ROSES 2018 amended)
    - This program is now interdivisional for ALL 4 SMD Divisions (APD, PSD, HPD, ESD)
    - Now encourages observational, archival, and theoretical investigations focused on the detection of *technosignatures*, as a direct result of the Technosignature Report sent to HQ from the workshop
  - D.2 ADAP (ROSES 2018 amended)
    - Now explicitly does not reject technosignature studies