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# The National Academies Space Weather Roundtable

Geoff Crowley, Ph.D. (Co-Chair)

Sarah Gibson, Ph.D. (Co-Chair)

Art Charo, Ph.D. Space Studies Board

# Space Weather Roundtable

Formed in response to the Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow Act (PROSWIFT Act → “Government-University-Commercial Roundtable on Space Weather”; 2020)

- Charged with facilitating communication and knowledge transfer among Government participants in the Space Weather Operations, Research, and Mitigation (SWORM) Interagency Working Group, the academic community, and the commercial space weather sector.
- Discuss activities to:
  - facilitate advances in space weather forecasting
  - increase coordination of space weather research-to-operations and operations-to-research
  - improve preparedness for space weather events.
- ❖ **Brainstorming group – generate ideas for other committees**
- ❖ **“Business as Usual” is not in the National Interest**
- ❖ **What are the Gaps & ‘blockers’ preventing improvements?**

Art Charo (NASEM)

Geoffrey Crowley: co-Chair  
Sarah Gibson: co-Chair

1 Hazel M. Bain

2 Anthea J. Coster

3 Janet C. Green

4 Jenn Gannon

5 Justin C. Kasper

6 Delores Knipp

7 Louis J. Lanzerotti

8 Mark H. MacAlester

9 M. Granger Morgan

10 Omar A. Nava

11 Geoffrey D. Reeves

12 Michael Starks

13 Leonard Strachan Jr.

14 Drew L. Turner

15 Louis W. Uccellini

16 Shasha Zou

Ex-Officio

*Mangala Sharma (NSF)*

*Genene Fisher (NASA)*

*James Spann (NOAA)*



# Roundtable in Relation to Other Space Weather Committees

**Space Weather Advisory Group (SWAG):** Also created by PROSWIFT, formally advises SWORM.

**Space Weather Council (SWC):** Advises NASA's Heliophysics Advisory Committee.

**Unlike SWAG and SWC, Roundtable is not FACA and does not make recommendations.**  
Allows for frank, deep dive discussions of orphan issues.

**Overlapping membership.** Frequent communication between leadership of SWAP, SWC, and Roundtable

US Space Weather Committees and their Members											
SWAG (15 members)						Roundtable (18 members)					
Craig Fugate (FEMA, ret)	Tammy Dickinson (Sci. Matt.) CHAIR					Mark MacAlester (CISA)	Leonard Strachan, Jr (NRL)	Michael Starks (AFRL)	Omar Nava (USAF)	Lou Uccellini (UMD)	
Michael Stills (FAA, ret)	Tomas Gombosi (U. Mich.)	Delores Knipp (CU)	Shasha Zou (U. Mich.)	Anthea Coster (MIT)	Granger Morgan (CMU)	Hazel Bain (CIRES)	Lou Lanzerotti (NJIT)				
Rebecca Bishop (Aero)	Seth Jonas (LMCO)	Jennifer Gannon (CPI)	Justin Kasper (BWXT)	Geoff Crowley (Orion) Co-CHAIR	Sarah Gibson (NCAR) Co-CHAIR	Geoff Reeves (LANL)	Drew Turner (APL)				
George Ho (APL)	Conrad Lautenbacher (GeoOptics)		Janet Green (Spa. Haz.)								
Scott McIntosh (NCAR)	Kent Tobiska (SET)	Nicole Duncan (Ball) CHAIR →	Dan Baker (CU/LASP)	Piyush Mehta (WVU)	TBD	TBD	Paul O'Brien (Aero)				
Mark Olson (NERC)	Heather Elliott (SWRI)		Ron Turner (Anser)	Michele Cash (NOAA)	Alexa Halford (NASA)	Sage Andorka (USSF)	Angelos Vourlidis (APL)				

INSTITUTION TYPES	
11 Academia	8 For-Profit
8 FFRDC/UARC	4 Individual / Consultant
4 DoD Civil Servant	3 USG Civil Servant
3 Non-Profit	

POCs	
SWAG	Jennifer Meehan <a href="mailto:jennifer.meehan@noaa.gov">jennifer.meehan@noaa.gov</a>
Roundtable	Arthur Charo <a href="mailto:acharo@nas.edu">acharo@nas.edu</a>
SWC	Kelly Korreck <a href="mailto:kelly.e.korreck@nasa.gov">kelly.e.korreck@nasa.gov</a>

## Connection to other committees

**Communication is key, and has been good in both directions**

- Deep-dive topics inspired by other groups
- Roundtable discussions can shine light on topic and provide material for other groups

# Space Weather Roundtable

- Meetings:
  - Monthly telecons
  - In-person Meetings (4<sup>th</sup> In-person Meeting will be July 8-9, 2024)

# June 1-2, 2023 In-person Meeting: Sessions

- **Reports from SWAG/SWC** (Seth Jonas, Jinni Meehan, Nicole Duncan)
- **Discussion of Space Weather Benchmarks** (Geoff Reeves, Mark Olson, Bill Murtagh)
  - Goal of establishing unified benchmarks for gov't + industry
- **Research to Operations/Operations to Research (R2O/O2R)** (Genene Fisher, Shea Hess Webber, Humberto Godinez, Janet Green)
  - Functional issues: need for new workforce, new ways of doing business
- **Lessons Learned from Terrestrial R2O/O2R** (Nikki Prive, Elsayed Talaat)
  - Observing System Simulation Experiments (OSSEs): where/how they are useful
  - Data Buys: progress, risk mitigation
- **Geospace Dynamics Constellation (GDC)** (Katherine Garcia-Sage, Paul O'Brien, Dan Baker, RT ex-officio)
  - Top recommendation of 2012 Heliophysics DS; explicit Space Weather impact; currently 'on pause'
  - 'A big bright light' on fundamental questions underlying Space Weather science.
- **Ground-based Observing Networks and Space Weather** (Jenn Gannon, Mike Farrar, Mark Engebretson, Asti Bhatt, Mike Hartinger, Anthea Coster, Dave Mencin, Glen Mattioli, Eric Donovan)
  - Orphan area – NSF does research, NASA and NOAA-NESDIS does space-based.
  - Networks are aging, nodes are disappearing, and plans for transition to operations generally unsupported.  
\*SWAG/SWORM recommendations\*\*
  - Lessons learned from terrestrial: multi-agency/commercial 'weird matrix of funding'.

# January 17-18, 2024 In-person Meeting: Sessions

- **How to improve communications between research and operations**
  - Is there a missing forum? How do researchers find out what operators want and vice versa?
- **R2O2R**
  - A recurring theme at Roundtable
  - Difficulties with transition R2O – different skills than research, and funding (where/who/how)
  - Role of commercial?
  - Effectiveness of readiness levels?
- **Discussions of:**
  - Benchmarks & Scales;
  - Modeling Gap Analysis (Piyush Mehta, Angelos Vourlidas)
- **SWPC Testbed** (Jinni Meehan for Bill Murtagh, Tzu-Wei Fang, Eric Adamson)
  - Scales, New Products, R2O2R Readiness Levels
  - Proving Grounds vs Testbeds? How evaluated? Unfunded mandate?
- **Cislunar and Beyond -- Radiation Environment**
  - ARTEMIS (Yari Collado-Vega)
  - SRAG (Ricky Egeland, Katie Whitman)
  - SWPC (Kim Moreland for Hazel Bain)
  - Spacecraft charging (Linda Parker)
  - NASA Engineering/Safety (Joe Minow)
- **Strengthening the Partnership between DOD and Civil to Advance Space Wx Enterprise**

# Discussion: DoD – Civil Agency Partnership

## **DoD has a funding issue that potentially impacts instrument availability and data availability**

- This may have a follow-on impact on scientists and science research in the US (NASA, NSF and NOAA)
- There is potentially a National Security aspect because of DoD interest in space weather data for research and operations
- Initially brought up by the DoD at the Roundtable
- Subsequently discussed at the NASA Space Weather Council
- Revisited last week in Roundtable Monthly telecon
- DoD is asking whether there is value in better coordination and collaboration with Civil agencies

**Consensus** - it can't be resolved in the Roundtable or NASA SWC committees, but needs to be taken up at the Federal Agency management level

### ● Questions to ask:

- Is there a common data repository that could be used by DoD, NASA, NOAA, NSF?
- Are there data that the DoD uniquely needs to collect and use?
- Can we connect the Gap analyses performed by NASA, NSF, NOAA, DOD?
- Can DoD's "Urgency of Need" be leveraged by other agencies?
- Does the recent 4-Agency MOU provide guidance on inter-agency collaborations?



## ~Deep-Dive Topics (sub-groups)

- ❖ **Ground-based Observations for Space Weather – Jan, Feb, April 2023 monthly telecon discussions, “Closure Session” at in-person meeting in June and final presentation by Gannon in August 2023 telecon**

### FOCUS OF THE SENSOR “CENSUS”

- Existing near surface observations (ground-based, airborne, or buoys)
- US-owned and/or maintained sensors and networks
- Priority to sensors identified by the PROSWIFT Act
- Priority to sensors with potential for use in space weather operations

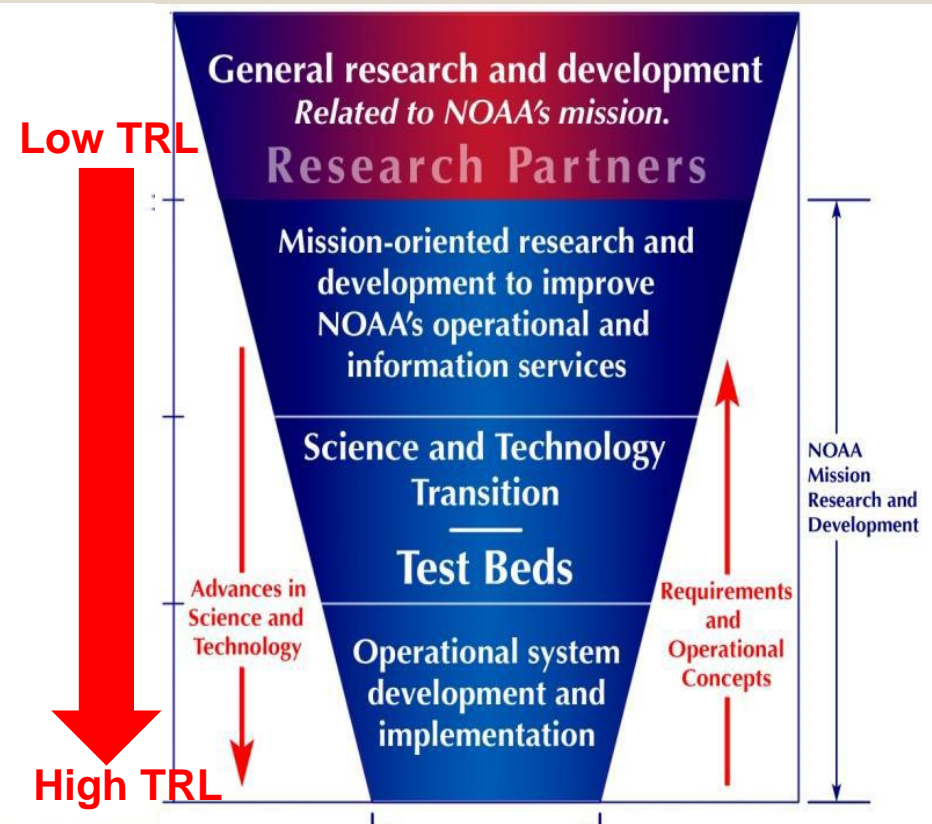
[National Academies Space Weather Roundtable, Past Events, August 22, 2023, Jenn Gannon](#)

- ❖ **Space Weather Benchmarks – July, August, September discussions with presentations by G. Reeves and M. MacAlester, and September guest C. Canizero and S. Jonas**

## Roundtable Successes (Related to R2O2R)

- ❖ R2O2R has been a recurring theme at Roundtable
- ❖ Recognition that its difficult to transition R2O
- ❖ Not enough funds to transition all research
- ❖ R2O transition uses different skills vs. Research
- ❖ Change is required in how we think about R2O2R
  
- ❖ **Success:** Roundtable provided a Forum for discussion
- ❖ **Success:** Our concern about R2O2R has been communicated to SWAG & SWORM (agencies)
- ❖ **Success:** Picked up by SWAG & SWORM  
Quad MOA, Space Weather Action Plan (SWAP)
  
- ❖ **Still near the beginning:** 2<sup>nd</sup> Innings of the conversation about R2O2R

# Space Weather Roundtable: R202R

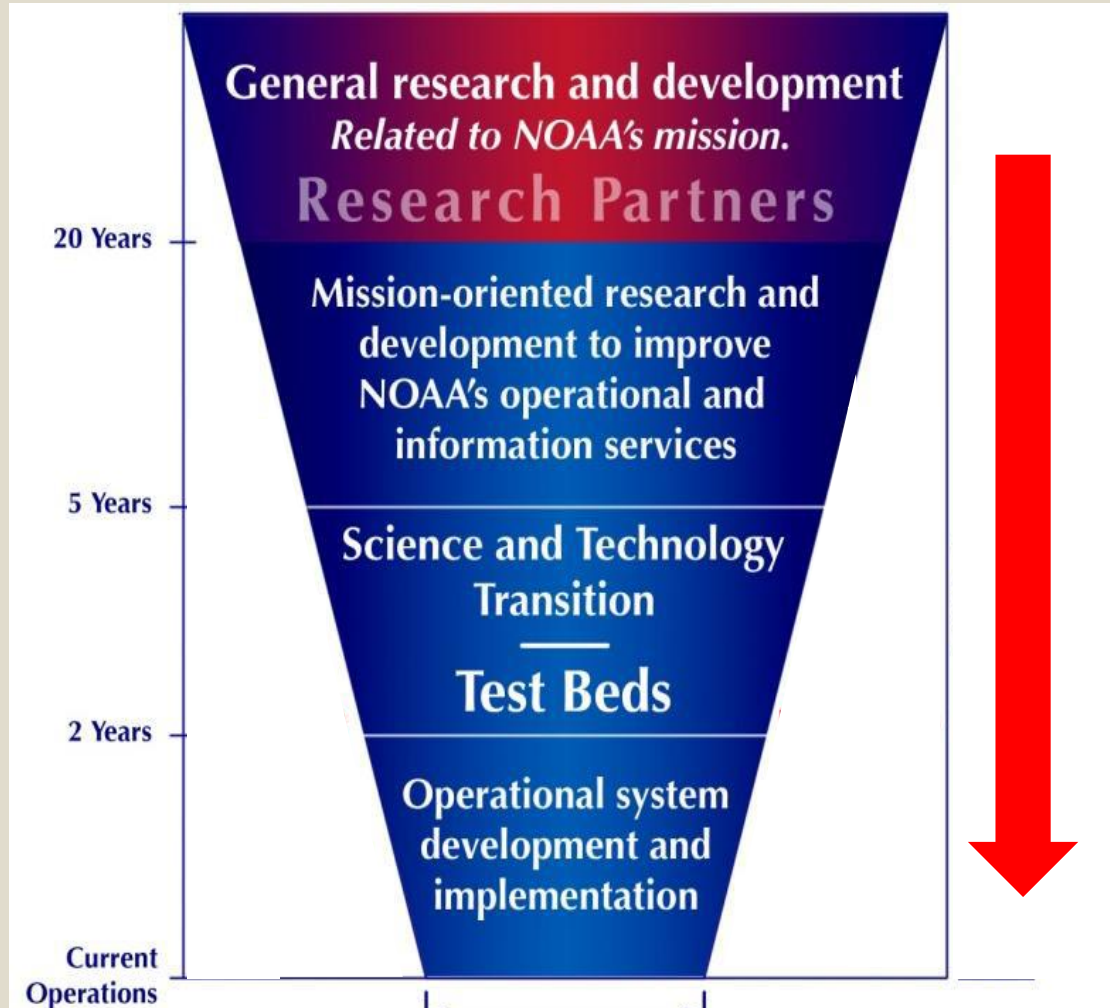


## How to Cross the Valley of Death?

- ❖ There is a large body of Research being performed
- ❖ Much of it is fundamental research (low TRL)
- ❖ How do we transition these capabilities?
- ❖ Skill-sets required to transition data and models is different than fundamental research
- ❖ What skills are needed? (Kubernetes, Containerization)
- ❖ Who pays for the transition to operations?

This raises another less obvious question:  
What is needed for Operations?

# R2O

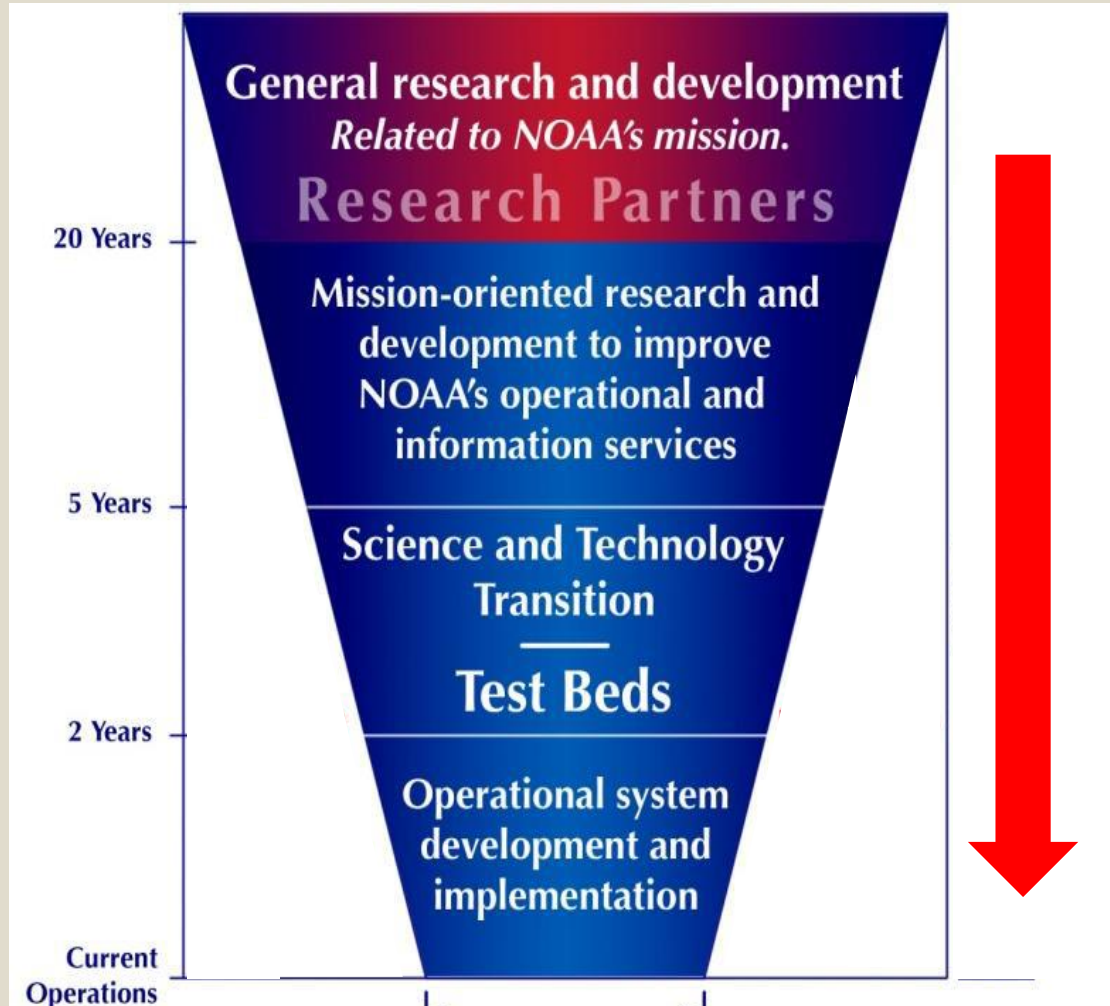


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# O2R

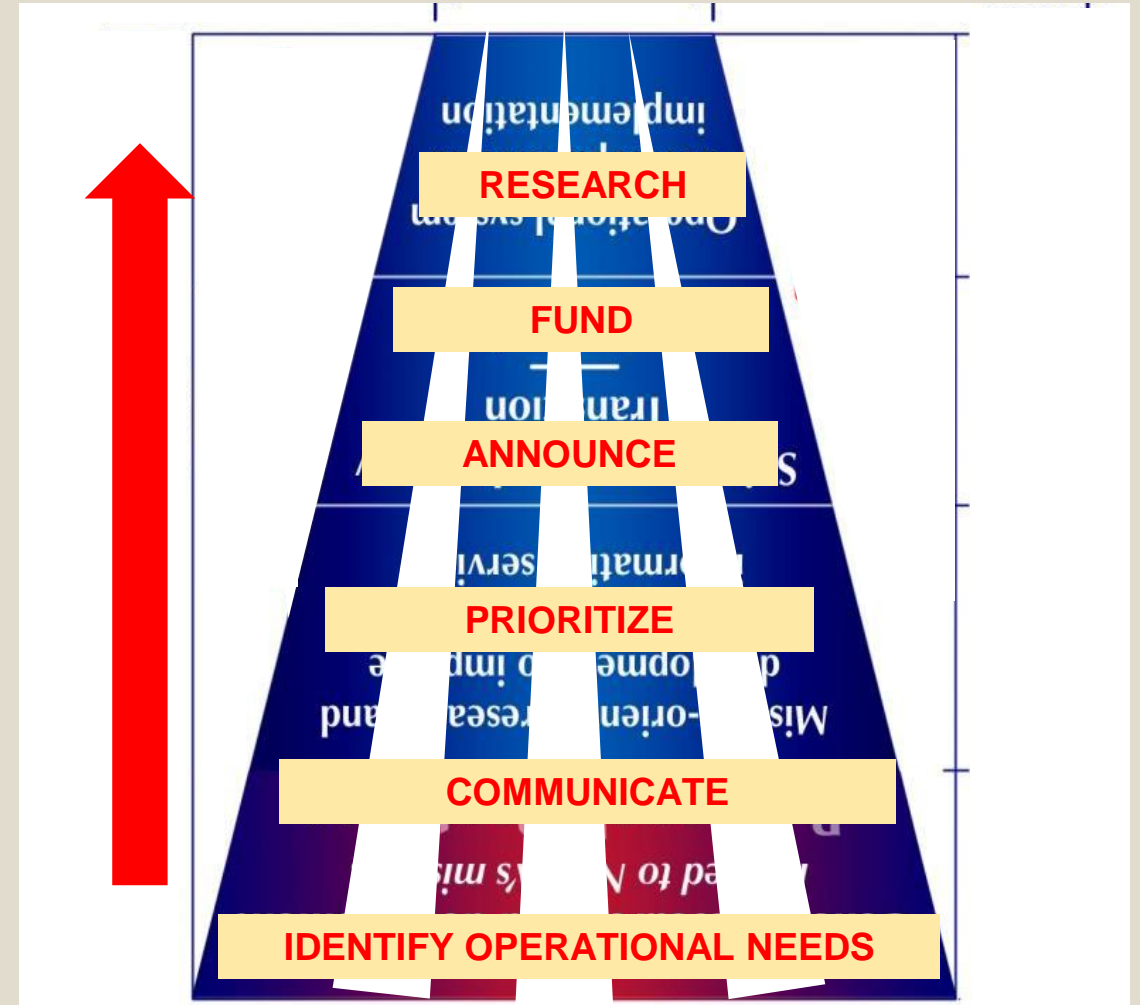


# R2O



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# O2R



## Is the O2R process going well?



# R2O2R - Where Can the Commercial Providers Contribute?

## ➤ Actions that could be taken to benefit from Commercial participation

- Recognize that commercial companies have useful capabilities (inclusion)
- Make people aware of commercial capabilities (inclusion, ACSWA)
- Refer Users to commercial companies that can help them (inclusion, ACSWA)
- Transition the products of SBIR development to operations: Ph-IIIE, Ph-3
  - ***SBIR products can be sole-sourced for transition to operations***
- Data Buys: Include ground-based (& ocean-based) data in data buys
- Government should not develop products that are commercially available
- Government should not be competing with commercial companies (hardware, models, data)
- Create special funding 'avenues' to take advantage of commercial capabilities (CWDP, etc) – currently easier for Govt to give money to UARCs or FFRDCs, or build it internally
- European Model – developers deliver models/algorithms to ESA who makes them available via website. Developer is responsible for software development and validation. Use at your own risk. ESA provides funding to develop, deliver, and then perform additional testing after delivery.

# Roundtable moving forward

## Roundtable funded for initial 5 year period

- Appointments
  - 3 year term with option to extend for up to 2 years
  - Staggered terms
- Ex-officio members come/go at discretion of NASA/NOAA/NSF
- The US Space Weather Enterprise is at the end of the 2<sup>nd</sup> Innings (a long way to go!)
- The Roundtable is nicely warmed up!

# DRAFT Agenda for July 8-9, 2024 Meeting

- **Reports from SWAG/SWC/SWORM**
- **SWAG Recommendation 5.2.3**
  - Needs and Progress in Thermosphere and Ionosphere Data and Model Validation
- **Recent APL Tabletop Exercise for Space Weather**
  - Is there any request for Roundtable input or review of Report?
- **'Gannon' Storm – report on Impacts and/or Mitigation Successes**
- **Partnership between DOD and Civil Agencies to Advance Space Wx Enterprise**
- **Other Suggestions?**