2021 Fusion Power Associates Meeting

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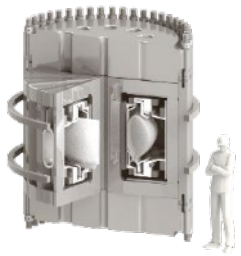
Commonwealth Fusion Systems

1. CFS status
2. Thoughts on shifting landscape

1. **CFS status**
2. **Thoughts on shifting landscape**

Risk retirement in concrete steps

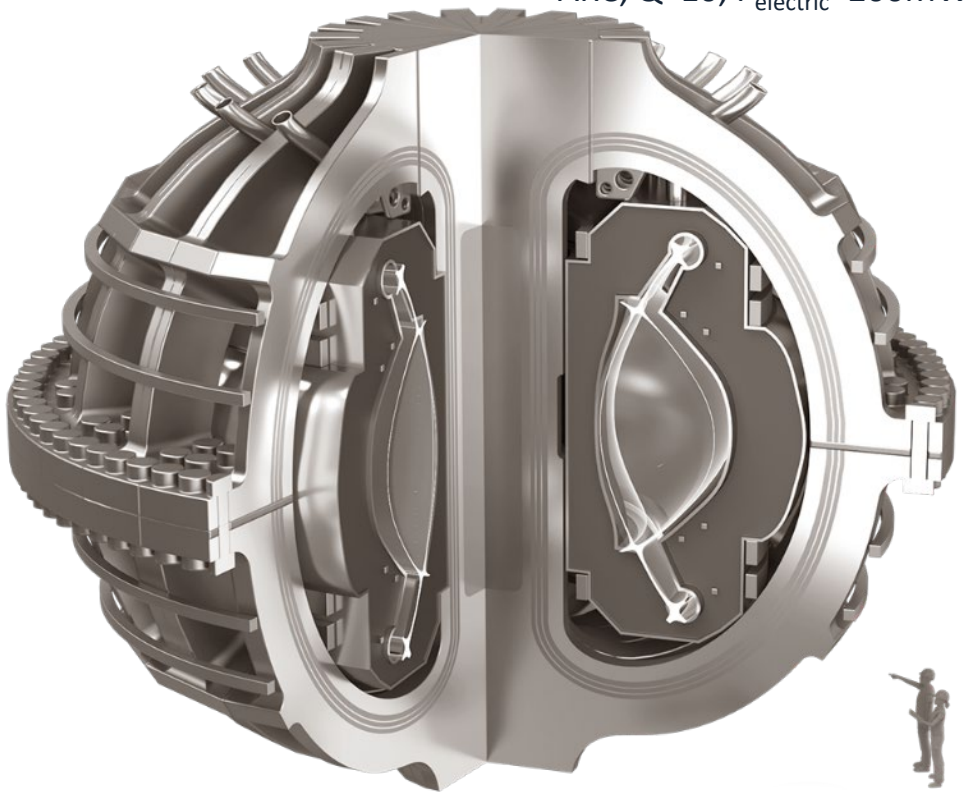
COMPLETED:
Proven science
Alcator C-Mod
$200M



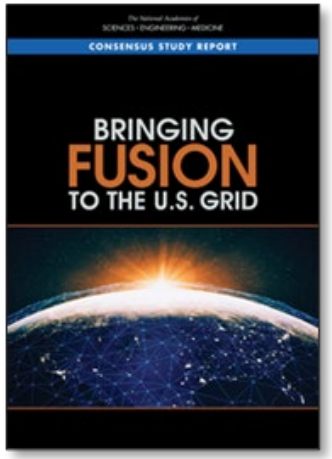
COMPLETED:
Demonstrate
Groundbreaking
HTS magnets at 20T

CONSTRUCTION UNDERWAY for 2025 LAUNCH
SPARC, Q>10
$P_{thermal}$ > 100 MW

Early 2030s
Fusion power on the grid
ARC, Q>10, $P_{electric}$~200MW



Fundamentally aligned with NAS Report

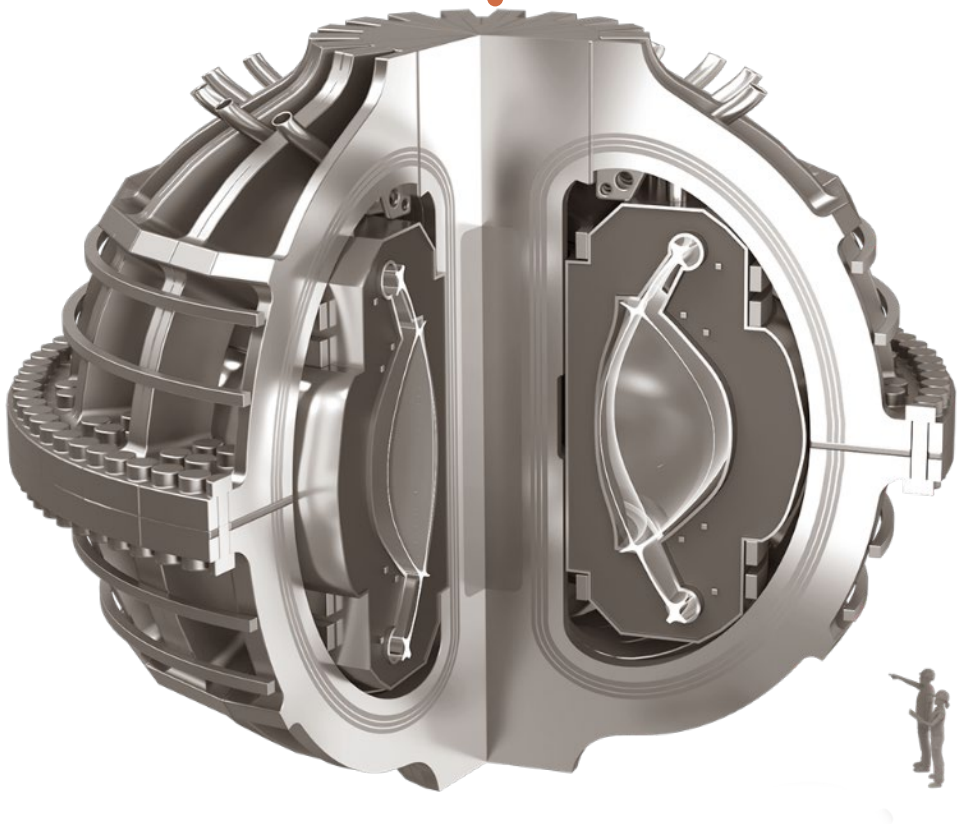


[1] National Academies of Sciences, Engineering, and Medicine 2021. Bringing Fusion to the U.S. Grid. Washington, DC: The National Academies Press. https://doi.org/10.17226/25991.

"Phase 1a: Production of net fusion plasma energy gain"

"Phase 1b: Capture and conversion into electricity"

"Phase 2,3: Production of fusion power for one/ many environmental cycles "

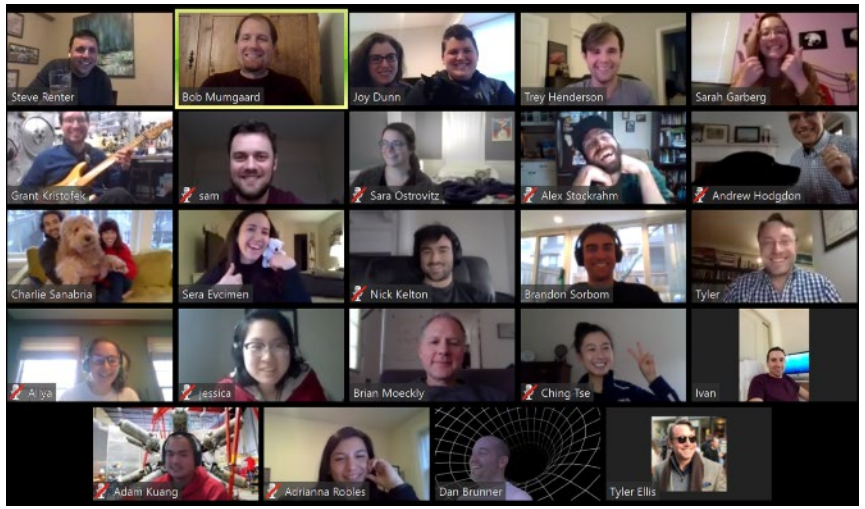


We have raised $2B to support our plans

- Not hypothetical – in the bank right now
- From a range of very serious partners who share our vision of a world-wide commercial fusion industry and want to help make it happen
  - High net worth individuals with strong relationships to government and industry
  - Energy companies who want to participate in a fusion economy
  - Large capital (endowments, hedge funds, pensions) who have seen industry-creation happen before and understand how it evolves
- They are becoming more actively involved in shaping the context and the policies around fusion, along with the other private companies
- CFS has the financing in place to build SPARC and start on ARC

CFS continues to grow

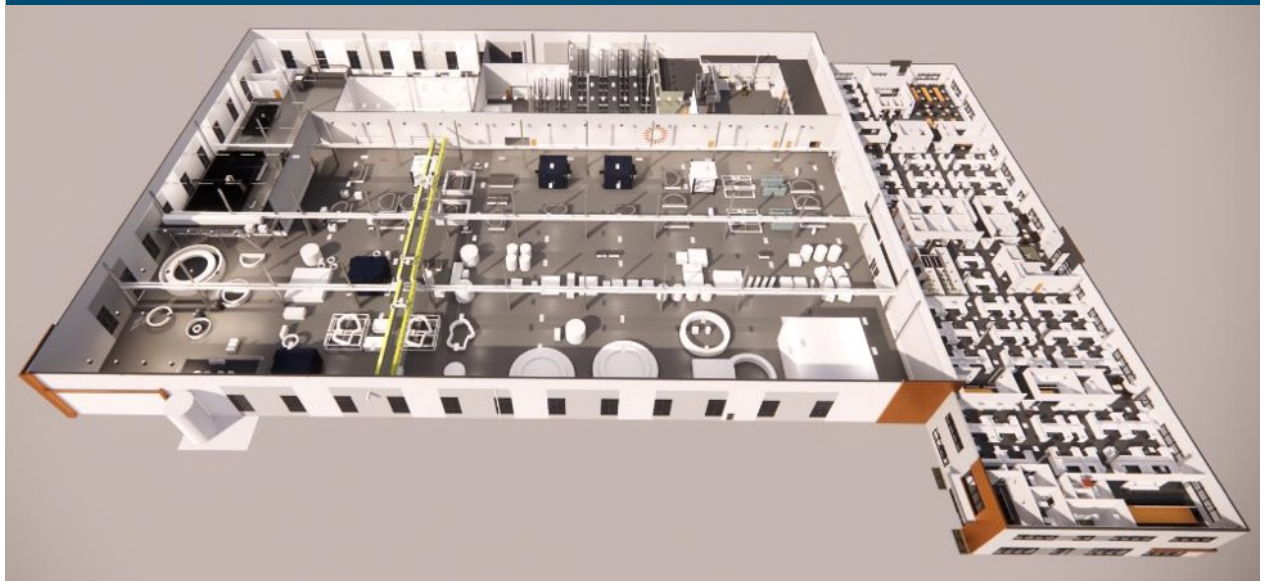
- 180 employees
- Going to double again this year
- ~300 on the team
- 5 locations, based in Cambridge
- From a wide range of backgrounds and experiences – all motivated by fusion impacting the energy transition



Production facilities are under construction

- Magnet factory and HQ sited with SPARC
- Produce the majority of magnets ourselves
- Scale needed for SPARC and ARC
- Vertically integrated capability to produce SPARC, ARC and magnet products

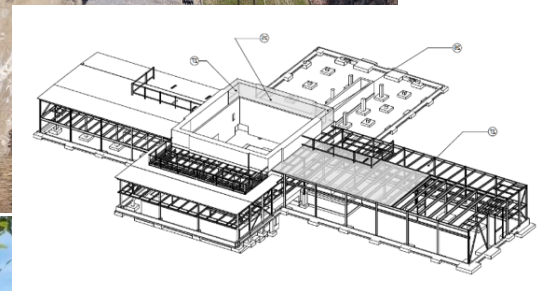
Magnet production for SPARC+ARC+products



World headquarters

SPARC construction underway

- Site selected after national search
- Will be an entire CFS campus eventually housing >1000 people
- Permits and environmental reviews completed
- State agreed to license process well on track, DT day one
- Construction of buildings on track
- Long lead items being actively procured



A burning plasma – domestic and commercial

- As of now there is no systematic way for the private industry to engage with government programs at the scale of the private endeavors
- CFS is on track to have a domestic privately owned burning plasma facility in 2026
- The community will have a new tool in its toolbox
- What will we choose to do with it?

We are starting work on ARC

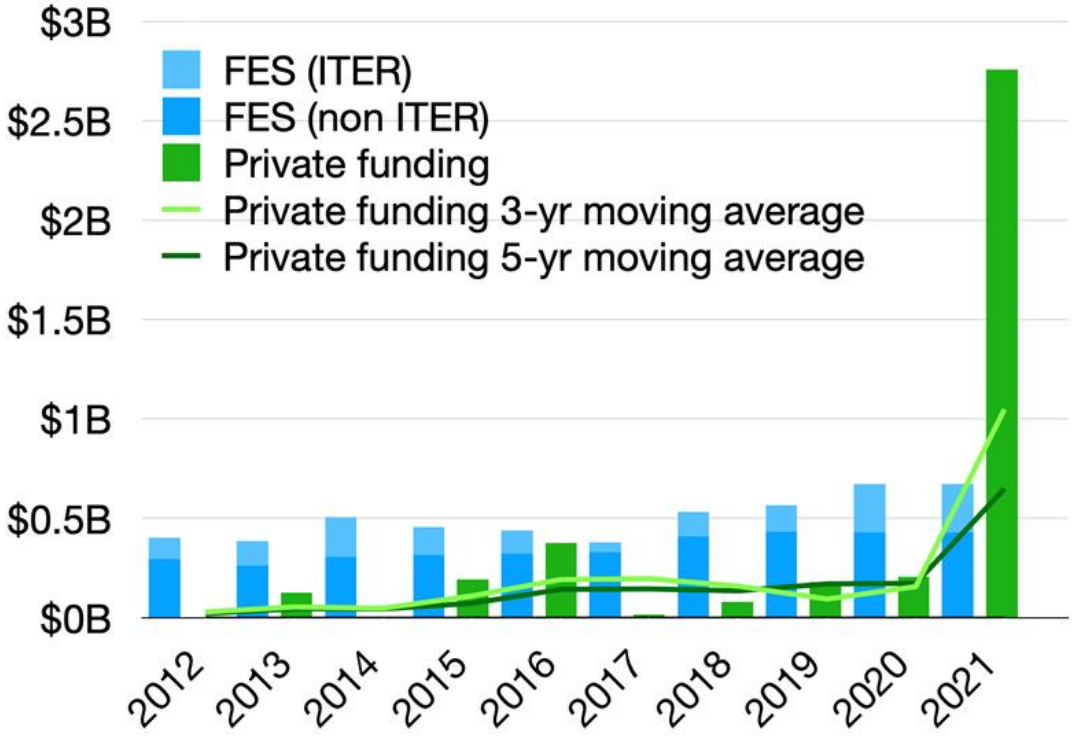
- ARC is a pilot plant– we are going to build it because it is needed for our business plan
- We have built a team of ~100 people who know how to design and build tokamak systems for commercialization and we are growing this every day from a variety of backgrounds
- We are continuing to invest our own money into R&D, design and integration of commercially relevant power plants, government $ <1%
- We are excited about partners to help design and raise TRL level of power plant subsystems
- We will need to freeze the design of ARC in the next 3 years – similar trajectory to SPARC – now is the time to engage

1. CFS status
2. **Thoughts on shifting landscape**

The fusion landscape is shifting rapidly

- Emergence of investment-backed private companies
  - Now with more money than the government programs in the US
  - This money will be spent
- Success of high profile programs in NIF etc
- Fusion excitement is clearly being driven by the energy transition and climate change
  - Audience has shifted and broadened
- Fusion has entered the mainstream energy conversations and will continue to grow there
- Congress and the White House interest is increasing, and they won't settle for status quo
- Race for fusion is about to start – geostrategic implications are coming to the fore

What does this mean?



Credit: Sam Wurzel

We know what we need to do

- The reports are done
  - NAS, FESAC
  - They are technically complete – gaps and gap fillers are identified
  - The problems are not going away – we can't just let the plans sit on the shelf
- The solutions need to be implemented to make progress – opportunity for growth for those that take initiative to implement them
- The timing is getting more compressed – need to align timelines with the evolving situation – how do we get creative to go faster?
- Energy is a market and fusion will need to be commercial – how do we build such an industry?
  - Start-ups growing or incumbent energy pivot or them working together?
  - How does the academic role shift from being alone to being a partner?

Things are going to continue to speed up

- Increasing number of stakeholders and viewpoints at increasing levels of visibility
- Likely to be a stick-slip transition
  - The status quo for the government program is clearly not going to meet expectations from stakeholders and needs to quickly evolve in missions, pace, and awareness
  - If we don’t start to implement plans and partnerships the pressure will continue to build on program leaders
  - Things could change quickly and dramatically – reorganization, new umbrella initiatives
- Organizations that navigate well will benefit
  - Attract and grow talent pipelines
  - Have new ideas funded, be able to transition legacy programs
  - Find their ideas and research embodied in early fusion systems

What will it take for your organization to navigate this?

Good things to have

- Climate relevant timelines and focus and partnerships
- Speed -- build-test-learn
- Capabilities demonstrated via hardware with solid execution
- Novel collaborations
  - Not just countries, but disciplines
  - Different types of organizations working together
- Commercialization pathway as a key input
- Initiatives and teams ready to do new things
- Organizational creativity and nimbleness
- A “default to action” strategy
- Expanding the pie mentality

Not so good things to keep

- A vague or unvoiced plan that lacks timelines, milestones
- A concrete plan that is not climate or energy transition relevant
- Scientific incrementalism
- Paper studies without hardware execution
- Technical spectacle via bigness, complexity, cathedral building
- Misunderstood roles for public/private – not knowing what you want to be when you grow up
- Rent seeking (cost plus etc.)
- Waiting for permission
- Focus on slicing the pie, trying to keep others down

We're better if we navigate this wholistically

- The community leadership needs to navigate their institutions through this
- Key questions we need to answer:
  - How do institutions evolve given their constraints?
  - Is this a geostrategic race (nationalism) vs cooperation vs coopetition?
  - Who is going to take advantage of advancing the low TRL technologies?
  - Role for convening functions – **what is the role of FPA?** What is the role of USBPO?
  - Where should fusion live in the DOE?
  - What would a 3x increase in funding mean?
  - How do we transition people and roles?
  - How do we grow the workforce in a diverse and inclusive way?
  - How do we take time out of the schedule?

It is getting more exciting…

How are you going to navigate it?

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