

2020 Fusion Power Associates Meeting

Bob Mumgaard

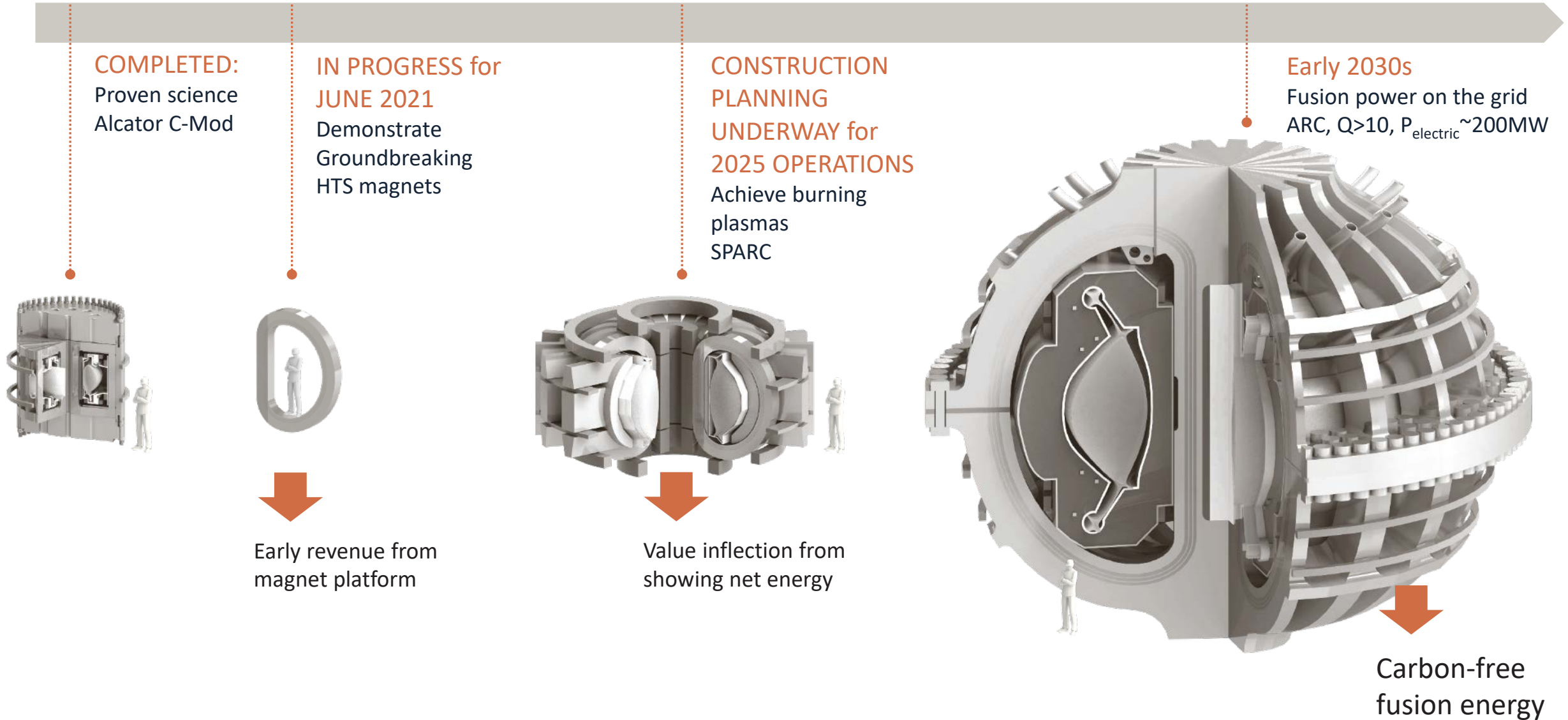
CEO Commonwealth Fusion Systems



- 1. CFS status**
- 2. Thoughts on Public-private partnerships**

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2. Thoughts on Public-private partnerships

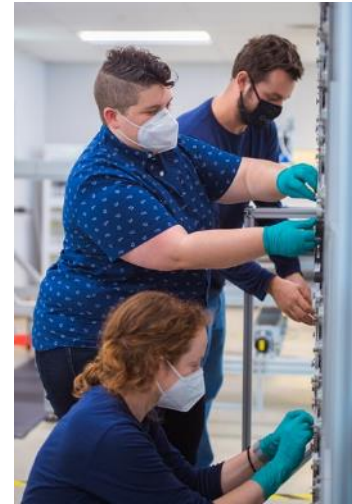
Risk retirement in concrete steps





CFS continues to grow

- 130+ employees, doubled since pandemic
- Added fusion-specific staff
- 250+ on the team
- 4 locations, based in Cambridge
- Since last FPA: +\$100M investment (>\$200M total)
- ARPA-e BETHA awards for CS coil, High-field mirror coil for WHAM
- Several INFUSE awards





Magnet work is on track

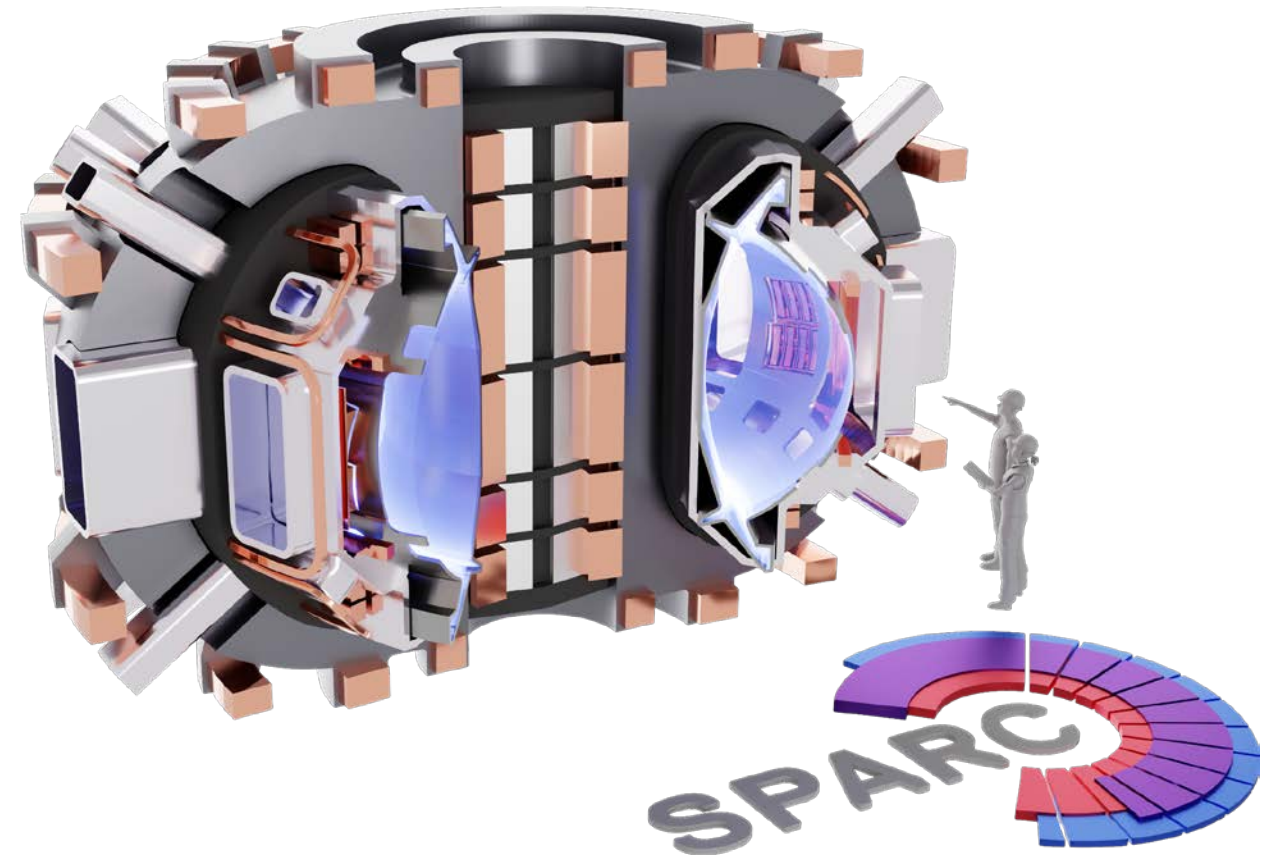
- Risk-retirement based R&D
- Full-scale model coil halfway through construction
- Same winding pack as SPARC
- 500km, HTS all in house, 50x more than any preceding magnet
- 100MJ, 5x more than any other HTS coil under construction
- On track to test to 20T in June on schedule





SPARC is $Q > 10$ and will access burning plasma for CFS

- $H=1$, $Q \sim 11$, $P_{fus} > 100\text{MW}$
- Plasma physics peer reviewed and published
- Same tools and assumptions as ITER
- This is an option for 2020s domestic burning plasma data
- We have started to engage in long lead procurements
- Target: DT before end of '25



SPARC facility on track to ground break in Spring



- Geotech done
- Combined with CFS HQ and manufacturing facility
- Building permits filed
- Agreement with NRC on licensing approach → State jurisdiction
- Tritium secured
- Site clearing at first thaw



1. CFS status
2. **Thoughts on Public-private partnerships**



We have entered an exciting new age in fusion

- Emergence of investment-backed private companies
- Robustness of the public-funded ecosystem
- Delivery of ITER
- Focus turning towards fusion as an energy source
- Increased discussion of how to accelerate by working together
- This is going to eventually be a geo-strategic race

What is driving this?

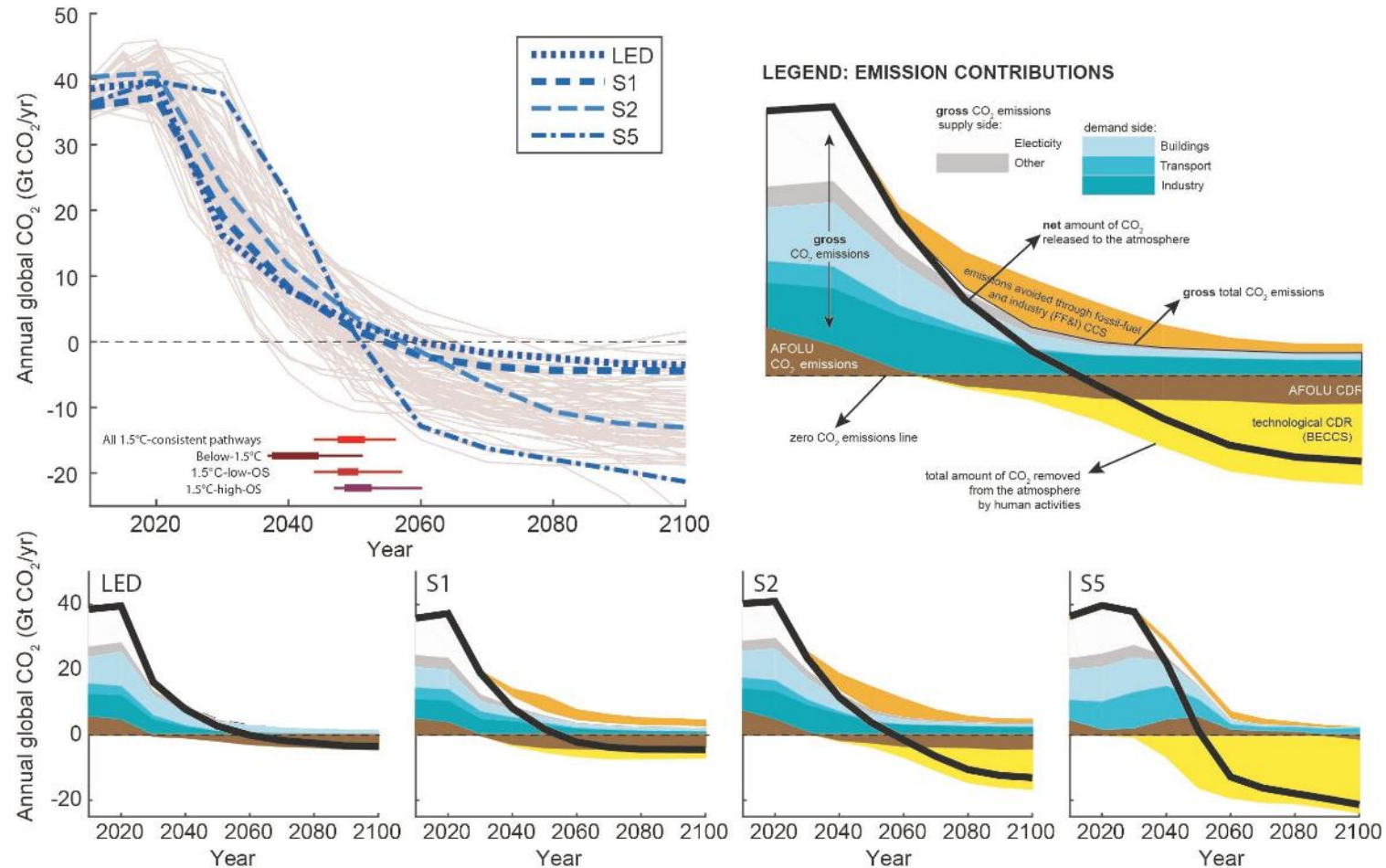
- **Fusion is not the story – fusion’s potential impact is the story**

Driven less by our success and more by our circumstances





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Growing number of companies have pledged net-zero by 2050



<u>Electric Utilities</u>			<u>Oil & Gas*</u>	<u>Materials</u>	<u>Airlines</u>

For others, see <https://sepapower.org/utility-transformation-challenge/utility-carbon-reduction-tracker/>

* These companies' pledges include scope 3 emissions.



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Driven less by our success and more by our circumstances

Sustainable and Responsible Investing in the United States
1995-2018

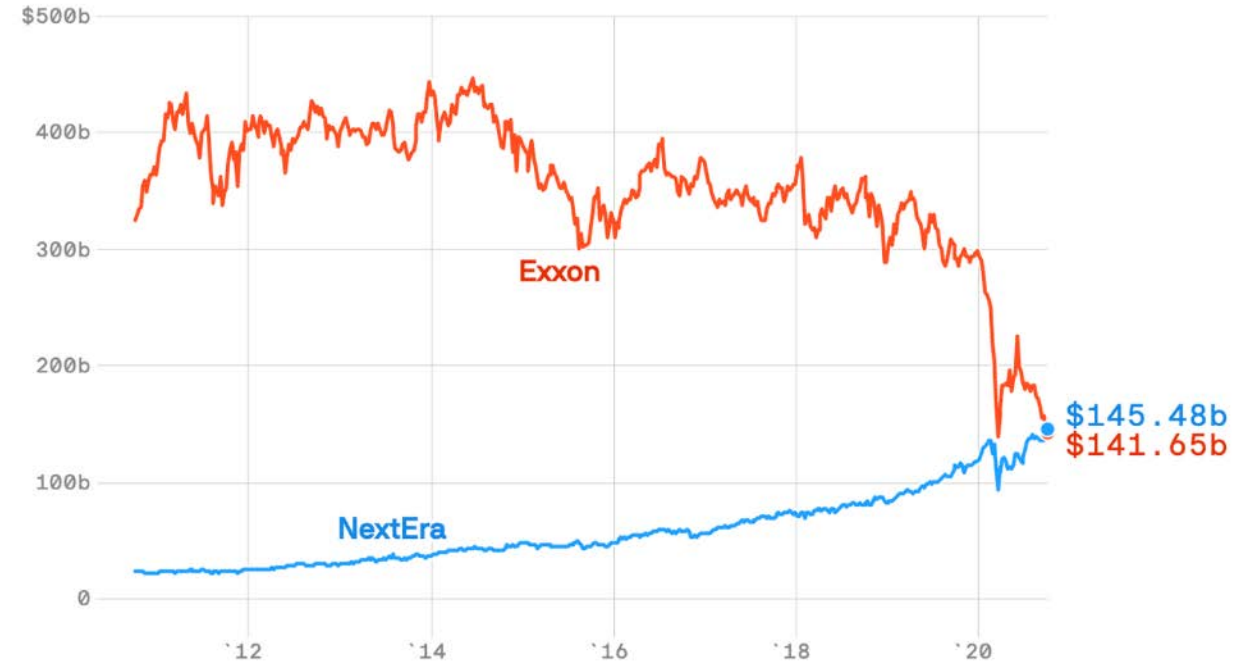
■ ESG Incorporation ■ Overlapping Strategies ■ Shareholder Advocacy



SOURCE: US SIF Foundation.

Market value of Exxon Mobil Corp. and NextEra Energy Inc.

Oct. 8, 2010, to Oct. 7, 2020





Fusion WILL be dominated by climate change

- Decarbonization is **THE** story of the energy landscape for the next 50 yrs
- If your lab/company/university/program doesn't have a plan on how it will impact climate change then you are going to be left behind
- If fusion does not participate in trying to solve the energy transition:
 - The field will lose the best and brightest
 - The field will lose the future market pull
 - The field will lose the public's trust for a generation
 - The field will lose funding
 - The field will lose private investment
 - The field will lose....



Fusion will be dominated by climate change

Fortunately, we are in the conversation!

- We must have a plan
- That plan, by our circumstances, will need to be ambitious
- We will then need to execute that plan and will be held accountable
- Half measures and words-only will not stand up to scrutiny
- The private sector has a plan and is executing
- **We need to find ways to work together**

What are public private partnerships?



Public private partnership



What are public private partnerships?

Public private partnership

- This is the broader public as represented by the government
 - Note that this is not the same as National Labs or Universities
 - A partnership can take many forms – direct \$, subsidy, collaboration etc
- What do they want?
 - A domestic fusion industry that can address climate change
 - A fast track to get there
 - This may or may not include support for institutions like National Labs or Universities depending on the alignment



What are public private partnerships?

Public private partnership

- Investment-backed private fusion developers
 - Each has a specific path toward fusion energy deployment
 - They need to produce an economic product
- What do they want?
 - Return capital by succeeding in addressing the energy transition
 - Aid for the highest hurdles in their development programs
 - To grow their capabilities to reach a reactor



What are public private partnerships?


Public private partnership

- Keys to partnership
 - Alignment on goals – Fusion in the 2030s
 - Alignment on responsibilities – best of both worlds
 - Recognition of the needs for both roles
 - Not just lip-service that both sides exist
- The alignment needs to go back to the broader policy goal not the goal of any particular lab or university



Common misconceptions

- That the PPP must meet the goals of the national lab's plan
 - Only true if the national lab's plan meets the goals of the public and private sides
- That the PPP must have high TRL levels
 - If there is private investors putting money at risk and the public policy is towards industrialization then they can partner
- That there must be a market-ready product after the PPP
 - PPPs are often done where there is no product yet. There is a PPP to build a moon base!
- In the end, the PPP can be many things. We can be flexible. The key thing is to align on goals between the US Government policy and the private industry. Don't just take a template and rule it in or out.



**It is exciting times, are the
programs up to the
challenge?**

Commonwealth Fusion Systems