MIT's Nuclear Cure-Alls

by Daniel Jassby

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In March 2018 a collaboration of MIT and CFS (Commonwealth Fusion Systems) announced that it would build a compact high-field experimental fusion reactor called SPARC that would produce 10-second pulses of 100-MW fusion power by the mid-2020's. That reactor would be followed in five years by a pilot plant called ARC that would generate 200 MW of electric power, and then by "the world's first commercial power-producing fusion plants." The CEO of CFS declared: "We think we have the science, speed and scale to put carbon-free fusion power on the grid in 15 years."

The announcement was accompanied by over-the-top endorsements from MIT officials. For example, MIT President Reif stated: "This is an important historical moment….. fusion energy [is] potentially within reach, offering the prospect of a safe, carbon-free energy future."

MIT Vice-President Zuber declared: "The MIT design…. puts fusion power plants within reach on a faster time-scale than previously thought possible;" and: "CFS, through SPARC, seeks to demonstrate fusion energy by the mid-2020s;" and: "If we succeed, the world's energy systems will be transformed."

If this ballyhooed reactor development program is plausible, then the National Academies Committee for Burning Plasma Research is superfluous, the Final Report is irrelevant, and all interested parties should now go home.

But wait! In contemplating the MIT-CFS euphoria it appears, as Yogi Berra liked to say, "It's deja vu all over again."

Ignominious Ignitor. In 2010, a similar compact tokamak enterprise called Ignitor was spawned at MIT by Prof. B. Coppi. Like SPARC, it was supported financially by Italian interests (mainly the government), and was a joint project of MIT, Italy and Russia. In Russia it was sponsored by E. Velikhov, at that time the most influential Russian leader of fusion R&D. A site was committed at the Kurchatov nuclear research facility near Moscow, where Ignitor was supposed to be constructed by 2015.

The Ignitor project was even announced with similar fanfare by the same spokesperson — David Chandler of the MIT News Office!

This version of Ignitor should be distinguished from previous copper-coil incarnations. Like SPARC, the new Ignitor was to use high-temperature, exceptionally high-field superconducting coils (HTS), but of a different material, namely magnesium diboride. The promoters promised that it would achieve essentially the same burning-plasma results as expected for ITER at a tiny fraction of the cost, claims now made for SPARC.

And what progress was actually made on the Ignitor project during the last eight years? There were rumors that a few sample components of Ignitor were fabricated, but those rumors were never confirmed. In effect there has been exactly zero progress. That's spelled Z E R O.

The MIT administration has swept the Ignitor detritus under the rug, while now making the same claims that SPARC and its follow-up fusion reactors will solve all the world's energy problems. But why does anyone expect SPARC to fare better than Ignitor? SPARC may have a website in the clouds, but Ignitor had a *building site* in the real world.

Transatomic trauma. As it happens, Ignitor is not the only recent MIT-related nuclear project whose promoters promised to revolutionize the world's energy supply in the very near future. In 2011 Transatomic Power, another Cambridge, MA company formed by recent graduates of MIT, and closely connected to MIT, announced that they were going to transform nuclear energy with their molten-salt reactor concept. It would be 75 times as efficient in burning uranium as conventional LWR's, and could even thrive on spent nuclear fuel. In 2014 they raised $5 million in venture capital, with a demonstration reactor to be built by 2020.

But in 2016 all of Transatomic's fabulous claims were debunked by independent reviewers, and now the project is languishing. No component of any type has been fabricated, and none ever will be.

If SPARC and ARC are linked closely to Ignitor through their HTS coils, they are also linked closely to Transatomic through their proposed molten-salt blankets. Whatever technical problems afflicted Ignitor's HTS carbon cure-all or Transatomic's molten-salt cure-all have now migrated to SPARC.

Quixotic crusades. Transatomic Power was a modern-day "children's crusade," proposed by children, led by children and staffed by children. Like Transatomic's reactor, the concepts for SPARC and ARC were first developed as a graduate student project at MIT. Its participants now populate CFS, thereby raising suspicions of another children's crusade. Ignitor was rather a "second childhood" crusade, given the advanced ages of its principal promoters. The concept of an "industrial engineer" is foreign to all three projects, whose promoters equate Powerpoint presentations with reality. (The latter is a trait shared by all fusion proponents.)

Interestingly, none of the MIT press releases for SPARC nor the extravagant ravings of MIT's Vice-President for Research mention either Ignitor or Transatomic. In fact there is a common thread to schemes promising nuclear energy utopia in 10 to 15 years. The commonality is that they all disappear within a decade and become unmentionable. In a few years when this SPARC begins to flame out, be on the alert for MIT's next carbon-cure fad.

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D. Jassby
PO Box 2240, Vincentown, NJ 08088
Email: dljenterp@aol.com