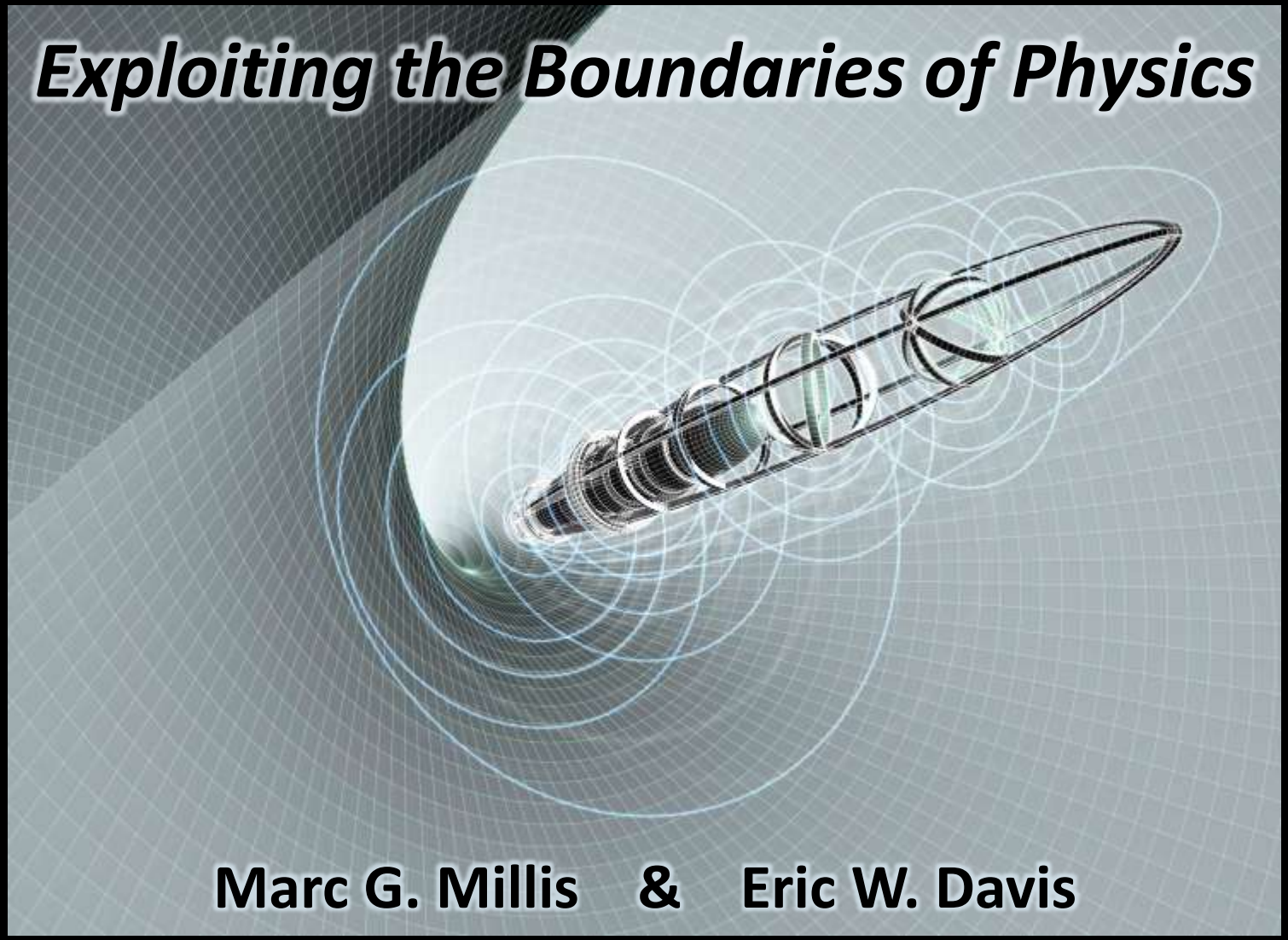
Warp Drives & Wormholes

Exploiting the Boundaries of Physics



Marc G. Millis & Eric W. Davis

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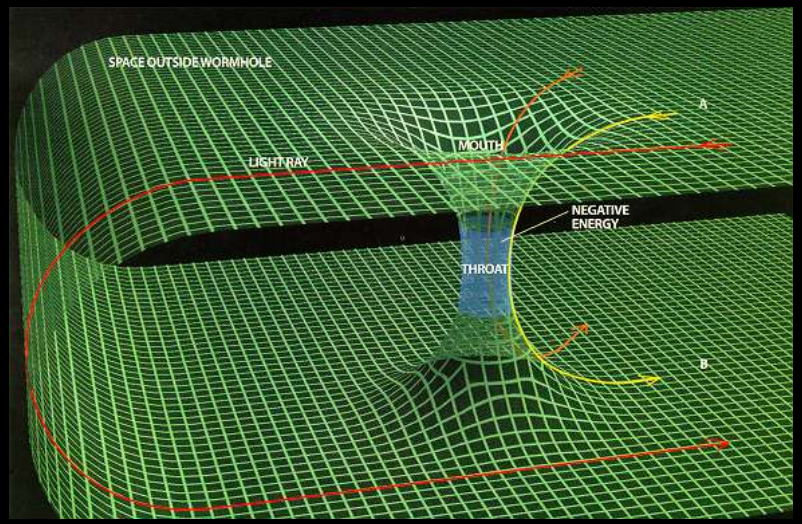
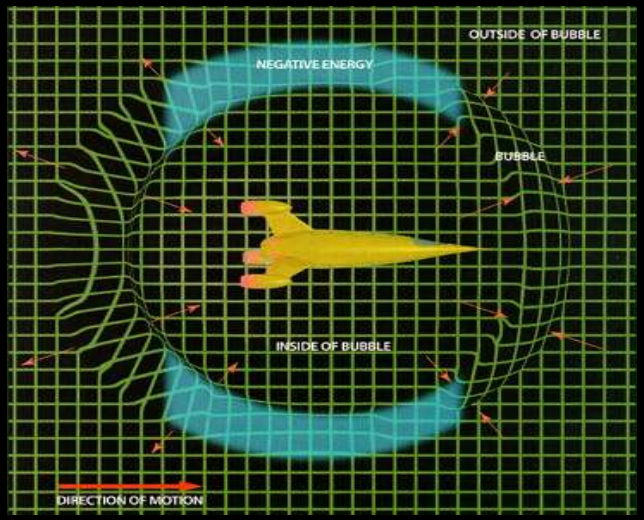
Geometric Spacetime Shortcuts

Wormholes - 1988



Warp Drive - 1994



Graphics from Discovery Magazine

Progress **?**

Conjecture	Speculation	Science	Technology	Commerce
"I want to believe"	Sci-Fi	Nature	Devices	Profitable Devices

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Brainstorming Faster-Than-Light

Multiple Notions

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Brute Fast
(Breaking Special Relativity)
[Like Cerenkov]

Tachyonic Conversions

Quantum Non-Locality

"Translocation"

"Hyper-stuff"

Sound Break Analogy 10^5

Hyperspace

Spacetime Shortcuts

Wormholes

Warp Drives

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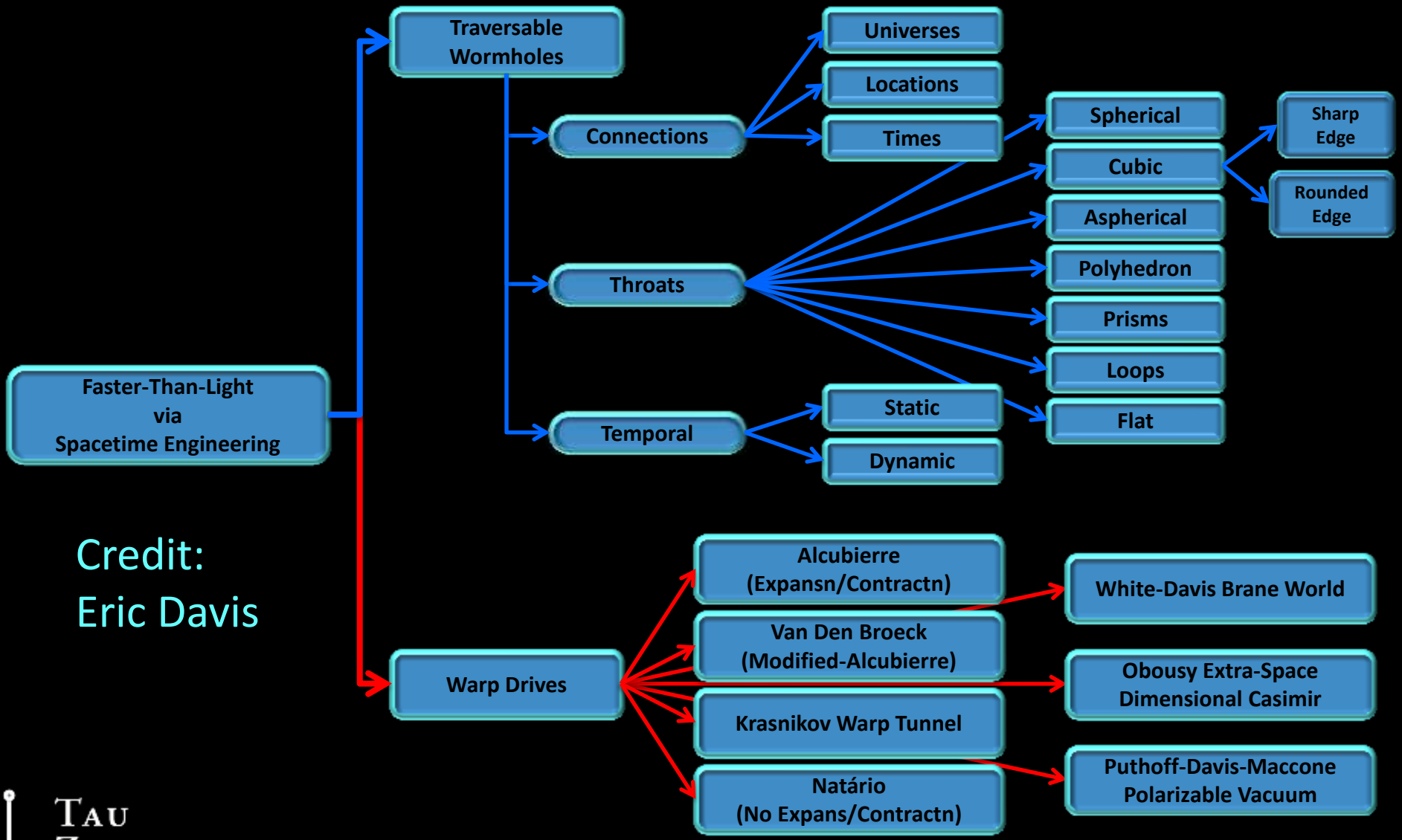
Space Warp Research Paths



Credit:
Eric Davis

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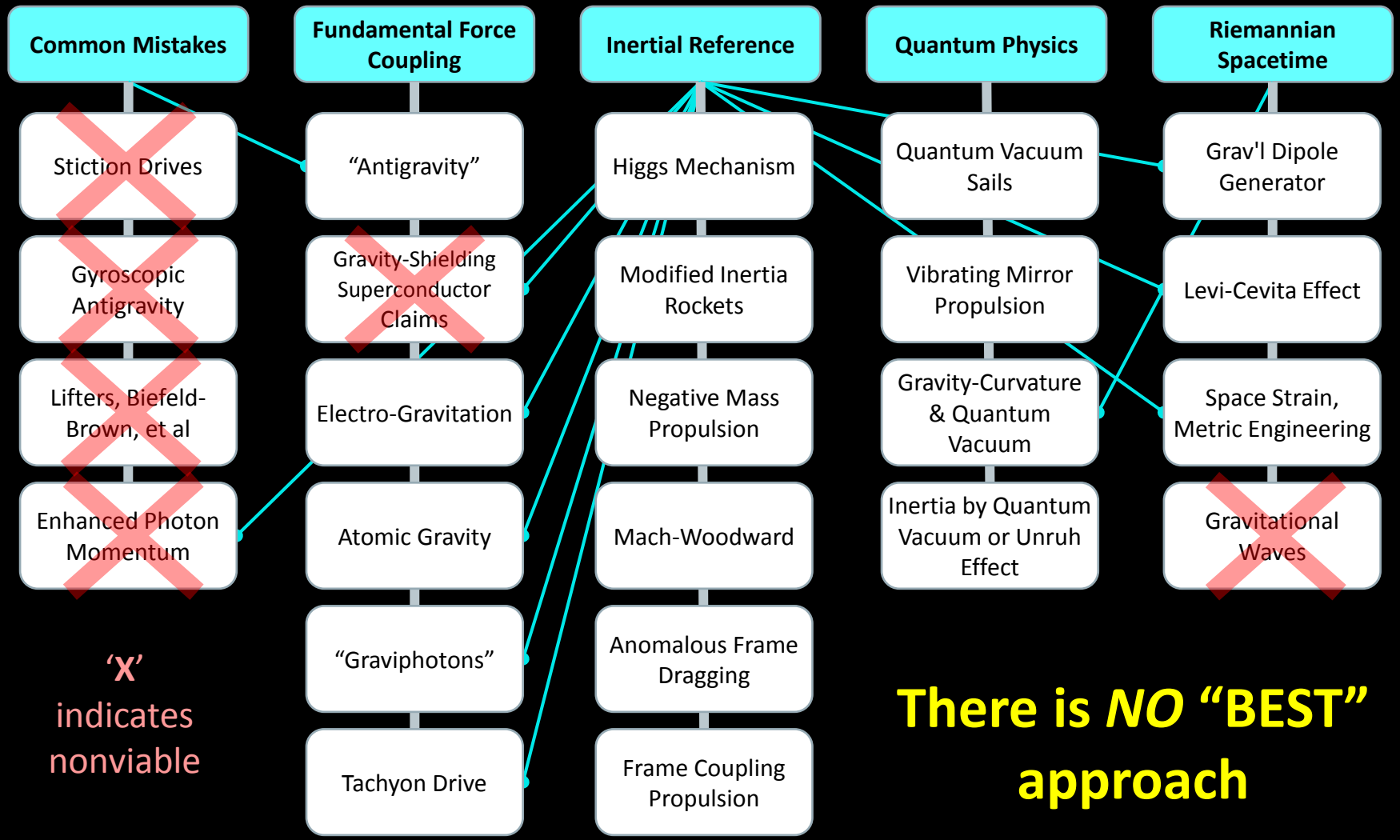
Space Drives Inquiries



'X' indicates nonviable

There is *NO* "BEST" approach

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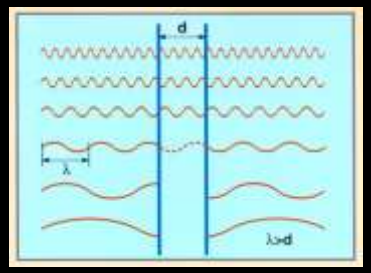
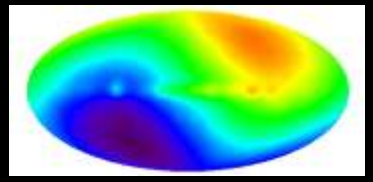
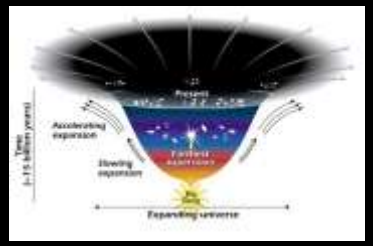
Deciphering What to Investigate

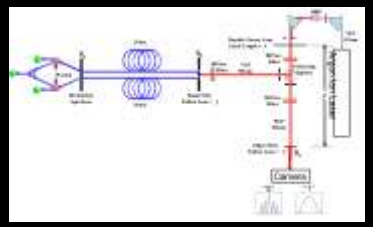
Contrast Now to Wow

Rigorous Foundations









What are the unsolved questions ?

Their intersection reveals the "Important Problems"

What are the critical issues and unknowns ?

Goal-Driven Visions

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BOOK: *Frontiers of Propulsion Science*

First scholarly book about

- Gravity control propulsion
- Faster-than-light travel
- Related energy conversion
- Managing such research

For scientists, engineers, and their managers

Extensive references

Published: *2009-Feb, AIAA*

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Warp Drives & Wormholes
Exploiting the Boundaries of Physics

Marc G. Millis & Eric W. Davis

ABSTRACT:

Ideas about faster-than-light travel matured from science fiction into scientific discourse in 1988. Since then, more than one approach has been conceived, and these topics now appear as homework problems in graduate textbooks. Although it is still not known if such breakthroughs can be engineered, the subject has advanced to where investigations are underway. In contrast to general physics, where the mysteries of physics are pondered in the context of the fate of the universe, the utilitarian perspective of spaceflight adds another solution approach with the potential to transform the fate of humanity. Presently the theoretical foundations that allow faster-than-light motion are an outgrowth of Einstein's general relativity. In contrast to the light-speed limit 'within' spacetime, Einstein's foundations allow the manipulation of spacetime itself – where different limits apply. The concept of a warp drive involves moving a bubble of space time faster than light can move through spacetime, while the wormhole concepts involve creating shortcuts through spacetime. One of the focal questions is how to create sufficient 'exotic matter' (with negative energy) to induce the desired spacetime warping. Another question is if such concepts are ready for experimental test. Additionally, these pursuits draw attention to the very meaning of conservation of momentum, physics of the quantum vacuum, and the very definition of mass and inertia. This presentation will introduce a variety of options, critical issues, and next-step research questions. For more comprehensive coverage , refer to the book: Millis & Davis (eds) 'Frontiers of Propulsion Science,' AIAA 2009.

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