Enzmann and his forgotten ideas

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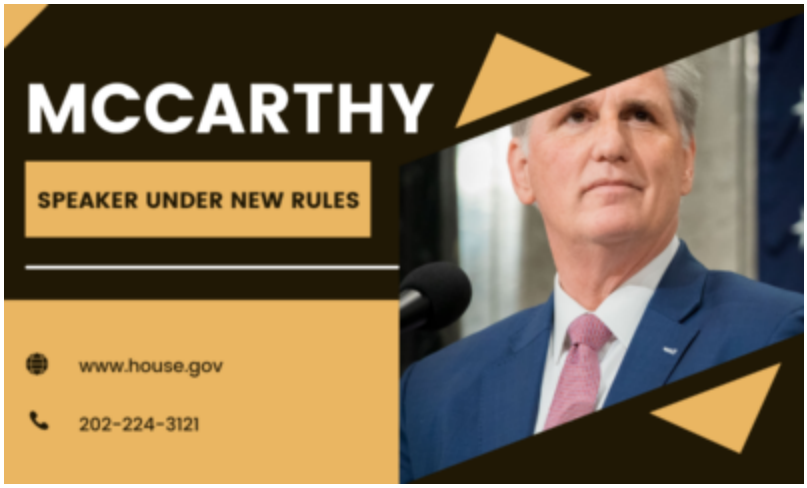

Two days ago, Elon Musk reminded the world of his primary driving ambition: to make the human race multiplanetary. In fact Musk has long held that, as long as human beings existed on more than one planet, no disaster could destroy humanity completely. Nor does it matter to him that humanity would divide itself into two or more separate civilizations. His planning for cities on Mars, with no attempt to normalize their gravity, shows this. But if the late inventor Robert D. Enzmann had had his way, humanity would have spread itself much further. Imagine, if you will, separate civilizations in multiple star systems, with a division that recalls the division of humanity on Earth before the development of instant communication and rapid transportation.

About Robert Enzmann

Robert Duncan Enzmann was born in Beijing in 1924. He watched the introduction of the automobile to that city within his lifetime. That experience surely inspired him to believe that technology would never stop advancing. Details of his life, and as much of his written articles and notes as have survived, are available from the Foundation for the Research of the Enzmann Archive.

He never stopped designing ever more exotic ships, many of which would seem impossibly large. But the concerted opposition from the academic community stunned him. It did not, however, turn him into a misanthrope. Instead he accused his opponents of misanthropy. Most of his criticisms would echo those by the “nationalist populists” of today. He never used the phrase “deep state,” but he would recognize its machinations and the ideologies it

propounds. No, he never anticipated the active encouragement of children to opt for surgical mutilation or hormonal poisoning. But he flatly accused the elite of his day of provoking war for no reason other than to achieve mass depopulation.

Were he alive today, he would no doubt join SpaceX as Director of Exotic Projects, or some such title. And SpaceX would have a far more ambitious space program than it now envisions.

Three kinds of starship

Today the word *starship* stands for SpaceX' concept for a heavy-lifting but totally reusable rocket ship. Even its booster stage would return to Earth for cleaning, refueling, and re-use, with occasional refurbishing. At least Elon Musk understands what no one in the industry even considered. Rocket engines are the most expensive part of any rocket ship, and boosters must carry the most powerful such engines, in the largest quantity. One does not idly throw these away! Already SpaceX offers launch services at the lowest price-per-mass in the industry, precisely from reusing boosters. The SpaceX Starship will make that reusability complete.

In 1949, while still a student, Robert Enzmann designed a true starship, that could fly an interstellar mission. The development and deployment of the atomic and hydrogen bombs gave him the idea. Why not detonate such bombs repeatedly, confine their blasts, and thus use them for propulsion? In fact Project Orion, still active then, had its basis in that same principle. But an Orion ship was supposed to have only one such engine. Enzmann proposed a ring, or cluster, of seven or eight such engines.

In his design, he placed a snowball of frozen molecular deuterium (heavy hydrogen), a thousand feet in diameter, forward. (Later concepts placed the ship's control country forward of this.) Immediately aft, he placed three cylindrical modules, each three hundred feet in length and diameter, along the long axis of the ship. A one-hundred-foot engineering module with the attached engine array would complete the ship.

Cancellation – and a newer concept

Sadly, NASA canceled Project Orion in 1960. Enzmann wrote that the managers cut up all prototypes into scrap metal and ended all discussion. But Enzmann never stopped thinking about his concept. In 1964 he would flesh out his design for a nuclear-pulse ship for publication. Nine years later, G. Harry Stine used that design for the basis of a "Program for Star Flight" that he published in Ben Bova's magazine *Analog*.

More recently, Enzmann scrapped his nuclear pulse design for another, radically different design. This he based, not on any chemical burn or fusion explosion, but a particle beam. He reasoned that at extreme relativistic speeds, the mass of the particles in such a beam increases many-fold – and significantly. A ship deploying such an "engine" could achieve

truly fantastic speeds, and stretch time on board. This ship would be much larger: 2600 feet long, 750 feet wide for the snowball “fuel tank,” and 300 feet in diameter for the main body of the ship. As before, the “tank” would lie forward of the habitation country, with the control country in the bow. This design is also more efficient, because it uses a fission-fusion reactor to power the particle beam, instead of setting off explosions.

Braking would be a different matter. Enzmann conceived of an energy-to-momentum conversion device, which he called a Gyrane. This functions *only* as a brake, but it can brake a ship even from relativistic speed.

Enzmann named this design the Torch class, from its appearance.

Specifications

The different specifications show why Enzmann came to favor this design. (Here *c* or “constant” stands for the speed of light.)

Property	Nuclear pulse ship	Torch ship
Maximum cruising speed, as fraction of c	0.3	0.98
Transit time to Alpha Centauri A/B, yr	15	4.6
Perceived transit time	13.7	0.18
Maximum carrying capacity, crew and passengers	2,000	10,000

Obviously the Torch ship can carry a larger colony contingent much farther, even if the journey lasts for generations. Remember: crew and passengers will perceive a much shorter interval of transit time than the actual interval. (But the ship will not actually take off with a full-capacity load. Especially in the generation case, the ship will need room to accommodate a larger company.)

Dr. Enzmann *did not* intend to send out either class of ship alone! He planned to send out fleets of ten ships each. Toward the end of his life he envisioned drive systems able to drive a ship at 0.99c. Such a ship would serve as a scout or escort.

If Enzmann and Musk had worked together

Enzmann died in 2020, so he *could* have served as Musk’s direct mentor. If he had, SpaceX might have proceeded somewhat faster in its development program. Almost certainly SpaceX would *not* have discarded the second stage of a Falcon Nine or Falcon Heavy. Instead, they would have programmed each second stage to navigate in orbit to join its fellows. These stages would have formed two clusters, one in low Earth orbit, and a smaller one in geostationary Earth orbit. (SpaceX *has* placed satellites in GEO.)

Enzmann might have speeded up the development of what we now think of as the SpaceX Starship. He would have wanted it soon enough to deploy a space-junk cleanup solution. Even if SpaceX had deployed that without asking anyone else to help pay for it, it would have suited Enzmann. He would have wanted to start as soon as possible to convert those clusters of Falcon second stages into a viable space station. It would first function as a fuel depot to support missions to the Moon – and a colony expedition to Mars.

Given the geopolitical environment (and Enzmann would have known all about that!), the two men would have made Mars their main base. Mars would be the ideal base to mine the asteroids for building materials, and Jupiter for deuterium. In a generation or two, SpaceX would be ready to take multiplanetary civilization to a new level.