[Existential Risk / Opportunity] Singularity Management

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Introduction to Keith Lofstrom's article

by James Blodgett

We have this quarter an article from a real hero of technological imagination. Keith Lofstrom is inventor of the Lofstrom Loop, described in 1981 and afterward in technical publications and featured in major science fiction. It consists of a metal cable in an evacuated tube, extending for 2000 kilometers. The tube and the cable then loop, return, and loop to rejoin themselves so that they form a complete loop. The cable is accelerated within the stationary evacuated tube until it is moving at faster than orbital velocity. Because of the cable's speed and its initial upward trajectory, it wants to go into orbit, but it is controlled magnetically to stay within the tube. Meanwhile the tube, lifted magnetically by the cable that wants to go into orbit, rises above the stratosphere and is held down by anchor cables. Maglev pods riding on the tube are accelerated by magnetic interaction with the moving cable and go into orbit with only the assist of a small kicker rocket to regularize their orbits. If this can be built, it would enable high capacity access to orbit at relatively low cost. See the Wikipedia article "Launch Loop" for more details. Keith is also a font of other ideas. Google his "Server Sky." Our article today is one of his many posts to the Power Satellite Economics discussion on Google Groups, with minor edits. In this article he is contributing to a thread regarding use of lunar resources.

I asked his permission to use this here because it is an example of the creative and expansive solutions that are sometimes possible in this field, and because it is a coup to have him publish here and expose our readers to some of his ideas. Keith agreed and suggested that I add the following two links:

First link:
http://server-sky.com/LunarResources

This is a link to the same article that appears below, this version hosted on his Server Sky website, but with additions. One of those additions is that he mentions that he has prepared the article for our Global Risk SIG. Another addition is several new links within the article. These links are a modern version of footnotes, to sources on the Internet that ground and extend his statements in the article. Another proposed future addition is that he plans to update the online version of this article over time.

Since the article is online, we could simply link to it, as we did with some of Alexei Turchin's charts of existential risk/opportunity topics in our October 2016 issue. However, it seems more straightforward to include the article here so it can be read when offline.

Second link:
http://server-sky.com/MooresLaws

I think Keith suggested this link as a dig at the "singularity" in our title. The standard version of "the singularity" is heavily dependent on Moore's law, and Keith questions that. Actually, I agree with Keith, and mean something slightly different when invoking the concept. Existential Risk/Opportunity Singularity Management is a title in the tradition of Tom Wolfe. Wolfe used titles that were intriguing but obscure, but that became clear as readers learned the argot of the social group Wolfe was describing. Terminology in our field is different when describing a future that is transcendently amazing in a positive direction, which we call a singularity, and a future that is transcendently amazing in a negative direction, which we call the actualization of an existential risk. Both are potential results of developments in science and technology, which has potential in both directions. I think it makes sense to put the two terminologies together, and talk of existential risk/opportunity singularities. I sometimes speak of positive and negative singularities, but this time I am going for the Wolfian complexity of using both the singularity and the existential risk terminology. Given that developing technology has both potentials, I advocate a quest to at least try to tweak the odds towards the positive direction. Calling an attempt to tweak the odds "management" is somewhat hubristic, but that hubris is part of taking on such a quest. The logic behind such hubris is expected value, which means probability times value. The value of

reaching a positive rather than a negative outcome is humongous when measured in the utilitarian metric of human lives. Even if the odds are low, the effort is worthwhile. And perhaps the odds are not low, especially if we try to do something about it, as Keith implores, and especially if we both use our heads, and work our butts off in the attempt, as Keith exemplifies. The word "management" will become real if we as advocates are successful in getting appropriate management protocols enshrined in law and in agreed best practice procedures. Sometimes such things really happen and really work.

Lunar Resources

by Keith Lofstrom

There are three kinds of lunar resources - those we can use someday, those we can create someday, and those we fantasize based on faulty reasoning. Most claims for lunar resources are wholly concerned with the last.

"Use someday" will involve designing machines and processes entirely different than those we've spent giga-man-years developing here on Earth with the kinds of stuff we find on Earth. Silicon, vacuum, and space UV will be /excellent/ raw materials for very different and very useful machines, and we WILL learn how to make them with somewhat less than a giga-man-year of development effort (but much more than a mega-man-year).

Not germane to near-term goals.

"Make someday" will be the long-term gardening of the inner solar system. REALLY long-term, millions of years, way beyond the imagination of exponential-millennialists. Most of the rock flying around up there is stone gravel. I can get that delivered for dollars a tonne. I have 100 megatonnes of undifferentiated rock under my back yard: http://server-sky.com/BackyardMinerals

But some of it is planetary core, differentiated by heat and gravity. Nickel iron is immediately useful.

The asteroids are Lyapunov-unstable; perturbations grow exponentially. Very small nudges grow to very large trajectory changes with megayear time constants. Job one is characterizing and tracking EVERYTHING tonne-size and larger to micrometer precision, then forecasting future trajectories.

Job two is using microthrust to steer the "useless" rocks into Mars and the "useful" rocks into the Moon. It will take millions of years to clean out the inner solar system of threats to Earth, but there is plenty of material with near-term collision potential. Shifting

trajectory by a centimeter per second can turn an Earth hit into a Moon hit in a couple of millennia.

We can "do trajectory" to micrometers per second today, through a thick blanket of turbulent atmosphere. Global precision geodesy is defined by the LAGEOS satellites, with which we observe continental drift, and calibrate GPS. Imagine what we can do with MANY observatories in space.

Someday, we will deliver specific precision-assayed asteroids to specific prepared locations on the Moon; I imagine deep curve-walled "melt pits" lined with refractory rock. The arrival kinetic energy at the Moon is about right to melt but not vaporize the asteroid. Ladle out the melt, zone refine it, and mold an enduring space civilization from it.

ENDURING; not the infection-model machine plague flaunted by Silicon Valley software geeks. As is, we've got another half billion years on this Earth of ours, should we choose that path. Wisdom is about what we SHOULD do, not what we CAN do.

A tiny tiny fraction of the asteroids are "in the groove" for Earth impact (or lunar impact processing) in the near term, but there are A LOT of asteroids out there. We can arrange a steady supply of useful materials; just the Near Earth Asteroids contain about 300,000 years of nickel-iron at current global usage rates. There is vastly more material between Mars and Jupiter, the source of the NEAs we have now, waiting for just the right nudge.

The process reminds me of log management at the McMillan-Bloedel lumber mill at Port Alberni, British Columbia, which I visited for a technology tour a couple of decades ago. The storm-battered coast of Vancouver Island produces some of the gnarliest trees (and logs) in the world. As logs were cut and delivered, they were 3D x-rayed for knots and imperfections, bar coded, and stored in a vast log pond, with their data stored in the small hard disks of the puny Sun workstations of the time. When an order for custom-cut lumber came in, they sorted through their log data base, mapped the 3D boards into the 3D trees, then pulled the logs and cut them to avoid the knots and imperfections (which became particle board or paper pulp). That mill produced some of the finest lumber in the world: long clear-span blemish-free beams for the repair of temples in Japan. Such unique "perfect" wood earns a 20x to 100x markup over ordinary construction grade lumber. Crap to gold.

If we are WISE and SMART, we can do the same thing for the entire solar system, all 380 trillion terawatts of it, and over a VERY LONG TIME extend the process to the entire galaxy. No, you and I will not live to see it; but then, the way most of us eat and exercise, we won't live long enough to see much of anything.

Choose life, not pathology. Create aids for human accomplishment, not autonomous robot plagues. If you can't tell the difference, leave the software cubicle farm and go work on a real farm for a season or two. You might invent something that helps farmers, so they aren't as likely to vote for people you don't like, out of justified fear of what you are inventing now.

Introduction to Leon Neihouse's article

by James Blodgett

Google [Don Quixote "The Quest"], and listen to a YouTube version of that song (The song is also called "The Impossible Dream" because of its first line.) [https://www.youtube.com/watch?v=RfHnzYEHAow] is a good version, but there are many versions; its quixotic nobility has been covered by many singers, including Elvis. If we are going to reduce existential risk, we need some of that quixotic nobility because there is no easy way. If there were an easy way, someone would have done it already. However, there are improbable ways, just as in the song there are unreachable stars. Indeed one of the ways to reduce existential risk is precisely to reach "unreachable" stars, an achievement that would go a long way towards reducing existential risk because settlements in other solar systems would backup humanity against disaster here. Trying the improbable is not crazy by the logic of expected value (probability times value), a standard metric of decision theory. If we explore a way to reduce existential risk, even though it seems improbable, the value of that exploration is our current population, seven billion lives, plus all future lives, a number that may greatly exceed trillions if we do reach the stars. Even one chance in a million of achieving this, times trillions, is, at least in the expected value sense, worth precisely millions of human lives. Few heroes of legend have saved more. Also, a lesson of our history of technological development is that things that were thought impossible not infrequently turned out to be quite possible. If we face the possibility of extinction of our species, it is a noble quest to do whatever we can to reduce that possibility.

We need heroes who are willing to take on such a quest. It is motivating to learn about such heroes.

Our hero here is Leon Neihouse, a member of our SIG. He has been exploring the possibility of setting up shelters that could survive some versions of existential risk. A simple version of this is as easy as building a fallout shelter in your basement, but an effective version is lots harder than that. A fallout shelter in your basement won't help much simply because many others have already done that, so humanity is quite likely to survive risks that can be avoided that easily even without addition of your additional shelter.

The shelters Leon is promoting are well beyond basement fallout shelters. He is promoting hermetically sealed survival shelters for communities of 10,000 people, powered by nuclear reactors, with internal greenhouses to provide food, and he wants to build several of those. He is using a version of a strategy I also advocate, the strategy of trying lots of things in the hope that something works. He applied for the recent MacArthur foundation $100,000,000 grant. He is also promoting a public benefit corporation tasked with several projects that would help provide money, he hopes to offer the ability to nominate some of the crew as a motivation for rich donors, and he suggests dual uses that may provide additional reasons for funding. Those uses include housing for refugees, preliminary testing of concepts for space settlements, and display of versions of such shelters in amusement parks.

Leon is exploring possibility space. Most of his ideas probably won't work, but some might, and he keeps exploring. Our militaries spend trillions protecting against dangers that we have become familiar with through long human history, i.e. that enemies will attack us. Some branches of the military, for example the Coast Guard, protect against less humanly-sinister natural disasters. It would make sense for us as a species to spend a larger portion of those military trillions to protect against existential risks. A bit of this is happening; NASA is studying orbits of comets that might be dangerous. We can take on the project of advocating for devoting more resources to that kind of project. If an entity with a military-level budget buys that advocacy, a Leon- level project might get funded.

Leon has already signed on several people to help. If readers are interested, he would welcome more help. If his projects get funded, this could develop into paid positions.

Fail Safe Institute: Concept of Operations

by Leon Neihouse

The Fail Safe Institute (FSI) is a proposed public benefit corporation with a mission to protect humanity from extinction. This will begin on Earth and eventually be extended into space. The initial project will be to design, build, and maintain settlements designed to survive many (but not all) potential human extinction events.

The settlements will be fully sealed with an internal air pressure greater than that of the outside environment. Power will be supplied by small modular nuclear power plants, two for each settlement to provide backup. Fuel for at least 100 years of operation will be provided by reprocessed spent nuclear fuel (SNF) and depleted uranium left over after the initial nuclear fuel enrichment process.

Three SNF reprocessing locations under consideration are, in alphabetical order, Ascension Island (UK), Christmas Island (Australia), and Navassa Island (USA). Prior to reprocessing, the SNF can use a storage facility patterned after the 120-acre site designed by Private Fuel Storage on the Reservation of the Skull Valley Band of Goshute Indians in Utah. The United States Nuclear Regulatory Commission issued a license for storage of 40,000 metric tons of SNF but non-technical factors prevented its startup.

Transfer of the SNF and depleted uranium to these sites will be by barge and heavy lift aircraft developed for this purpose. The reprocessed SNF and depleted uranium will be stored at the reprocessing sites until required at the settlements. This will be a continuing process such that each settlement will always have enough fuel in reserve to last for a minimum of 100 years.

Settlement details such as cost, number (as many as 12), size (10,000 range), occupants (families preferred with refugees as recruitments of choice), and operation of the settlements will be determined at a later time but boundary conditions will include full immersion in the settlements during ten year employment contracts, placing no limit on family size, permitting departure prior to contract completion under conditions to include but not be limited to personal health or death of an immediate family member, and allowing for private home ownership with sale to others if departing after contract completion.

For a SWAG (scientific wildly aimed guess) each settlement will cost 10 billion dollars. A wealthy individual and/or large company will be invited to serve as the financial partner for each settlement. The sponsor will have naming rights to the settlement and will be entitled to select 20% of its occupants. The remaining occupants will be selected by an international agency under the auspices of the United Nations.

An attempt will be made to obtain additional funds by development and commercialization of project spin-off such as indoor farming, green energy, and model exhibits of project facilities. Also, settlements will be used to model and test aspects of space settlement design. When humanity begins to settle and industrialize space on a large scale, that will provide a backup for Earth. The Fail Safe Institute hopes to play a role in facilitating that aspect of space settlement.

Potential FSI participants (Directors, Executives, Advisors, and Consultants) now include, in alphabetical order:

- **Mark Campagna** - United States Naval Academy: LinkedIn Profile. Mark, with extensive experience in all phases of nuclear power plant operation, will provide advice and consultation on selection and acquisition of the modular nuclear power plants at the settlements.
- **Clinton Crackel** – Cofounder: Spent nuclear fuel reprocessing coalition: LinkedIn Profile. Clint will provide advice and consultation on the SNF reprocessing planned at selected island locations.
- **James F. Carberry** - University of Missouri: LinkedIn Profile. Jim, as a former reporter for the Wall Street Journal, will provide advice and consultation on press releases and tweets for publicizing FSI efforts.
- **James Ertner** - MIT: LinkedIn Profile. Jim, whose MIT Master's thesis was on concrete ships, will provide advice and consultation on concrete barges to be used as a possible platform on which the settlement nuclear power plants will float.
- **David Forkey** - L.L. Bean: LinkedIn Profile. David, with extensive experience in Human Resources, will provide advice and consultation on employee pay and benefit packages.
- **Alan Hale** - United States Naval Academy: Lifeboat Advisor. Dr. Hale, as Co-Discoverer of Comet Hale-Bopp, will provide advice and consultation on acquiring and interpreting the calculations associated with a potential asteroid impact event.
- **Thomas D. Hall** - Maine Maritime Academy: LinkedIn Profile. Tom, with extensive Toastmaster experience, will provide advice and consultation on YouTube videos and a standard public presentation.
- **Eric Hunting** - Jack of all Trades: Lifeboat Advisor. Eric will provide advice and consultation on the design and operation of the R&D facility planned south of Dallas.
- **Norman G. Kurland** - President: Center for Economic and Social Justice. Norm, as a colleague of the late Louis Kelso, will provide advice and consultation on the organizational structure.
- **Peter Lizanecz** - Retired Chief of Police, Bath, Maine: LinkedIn Profile. Pete will use his experience in law enforcement to provide advice and consultation on ways and to keep FSI spaces free of unsavory characters and dangerous weapons.
- **Robert Lydon** - Rensselaer: LinkedIn Profile. Bob, with extensive managerial experience at Alion Science & Technology, will serve a ten-year term as FSI Chief Operating Officer.
- **Leon Neihouse** - MENSA: Lifeboat Advisor; LinkedIn Profile. Leon, as proposer of FSI, will serve a ten-year term as its Chairman and CEO.
- **Brian Spaulding** - MENSA: LinkedIn Profile. Brian, as a CPO and U.S. Navy retiree with extensive FBM submarine experience, will provide advice and consultation on refurbishing decommissioned FBM submarines for service as barges for SNF transfer.

Ten of the thirteen have United States military service in their background; eight anchored aweigh with the U.S. Navy (two submerged and six on the surface) and two flew into the sky with the U.S. Air Force.