REQUEST FOR INFORMATION (RFI)100 YEAR STARSHIP™ STUDY

The United Societies in Space Model

3 June 2011

Dr. Marc M. Cohen, Arch.D
Marc M. Cohen Architect, PC
4260 Terman Drive #104,
Palo Alto, CA 94306-3864
(650) 218-8119
marc@astrotecture.com

Declan J. O'Donnell
Law Office of Declan Joseph O'Donnell, Esq.
777 Fifth Ave.
Castle Rock, Colorado, 80104
(303) 688-1193 Office Phone
isdac.usis@gmail.com

The central question for this RFI is ***how*** to establish an organization that can carry on the long-term research and development necessary to develop a starship over a 100-year effort: the "**how**." Both "whats:" **what** model for long-term technology development and the **what** for resources and financial structures flow from this "**how**" question.

Organizational Models

In the space community today, there are essentially three organizational models: civil agency (NASA, ESA, Roscosmos, JAXA, etc.), the military space commands, and the non-governmental organizations (NGO). To understand the issues, we explicate the strengths and weaknesses of each organizational construct, as shown in TABLE 1.

TABLE 1 evaluates five types of organizations as candidates for the long-term support of the 100YS. Granted the emphasis is upon non-governmental action, but there are many other attributes to consider. The candidate organizations are Civil Space Agency, Military, International NGO, University, and for-profit Corporation. TABLE 1 assumes NASA as the model for the civil space agency; not only does it enjoy a budget six times larger than ESA --the next largest space agency-- but author Cohen served in NASA 26 years and knows it intimately. For the military paradigm, the model is the USAF Space Command. For the purpose of this analysis, the civil and military models are considered as national – belonging to one country – because that is how they exist (but capable of international collaborations). The NGO is considered as an international, non-profit collaboration; such entities exist and for simplicity, it enjoys non-profit status in each jurisdiction where it operates. A university offers a model of organization that has succeeded for hundreds of years in many countries, although the 100YS enterprise may not fit well with the academic mission to educate and create new knowledge. A for-profit corporation is a model that also has persisted for hundreds of years, although the profit motive would tend to obviate any potential interest in a 100-year enterprise almost guaranteed not to return a profit. Each of these organizational types offer instructive strengths and weaknesses suggested in TABLE 1.

TABLE 1 reveals that an international non-profit NGO (INGO) shows the greatest advantages as a model to develop and sustain the 100YS. Yet, what is most important, beyond this century of R&D, the INGO presents the greatest potential to transform itself into the organizational entity that can put a crew on the starship and transfer its system of governance to the starship crew, thereby forming a new society, suited to human adaptation to extraordinarily long-duration spaceflight.

TABLE 1. Types of Candidate Organizations for the 100 Year Starship™.

Criteria	National Civil Space Agency	National Military Space Command	International NGO	University	For-Profit Corporation
Dependence upon government funding	Entirely dependent except for services provided to customers	Entirely dependent but largely secure.	Can accept gov't funding, but must have other sources as well.	Not dependent for existence, but for R&D.	Can compete for contracts, but needs its own business.
Vulnerability to domestic politics.	Extremely vulnerable to pork barrel politics	Mostly immune, rarely affected significantly.	Largely unaffected.		More an actor than a victim.
Vulnerability to international politics.	Part of the process of partnering	War is politics by other means.	Some can bridge the gaps (e.g. Red Cross)	Not usually engaged or affected.	Business is affected, can play politics.
Ability to raise (bonds) or borrow private funds	Not possible		Yes		
Ability to raise (bonds) or borrow public funds	Tax-dependent	War Bonds	None	Public Universities may issue bonds	A major basis of private wealth
Private Endowment	No		Yes		Possible but unlikely
Ability to perform independent R&D	Possible but unstable.	Tends to be restricted to defense applications	Yes, provided funding is available	Yes, under basic research grants.	Tends to be near-term product-focused.
Ability to organize and run a consortium	Yes	Very limited	Yes	Only as one of several partners	No, inimical to competition for profit
Ability to compete for government contracts.	Limited but possible.			Research but not services.	Yes
Compete for commercial contracts.	No			Extremely limited.	
Develop Industry	Not Primary				
Job Stability	Excellent	OK if you're not KIA	Variable	Excellent	Generally uncertain.
Creativity-Driven Career Growth	Not as good as earlier programs.	Forget it.	Essential		Valued but also suspect.
Ability to recruit young people	Extremely poor with downsizing	Constant	Variable	Excellent	Variable.
Ability to retain people.	Excellent	A constant problem	A challenge	Retain only the best	Poor
Ability to self-govern.	Subject to President & Congress		Yes	Public universities subject to legislature	Excellent
Ability to become a new society	No			No	

The Starship Mission and Crew Factors

What is most distinctive among the criteria in TABLE 1 is the INGO's ability to translate itself into the crew of the Starship. No other organization type can achieve that purpose. Given any technology that is realistically achievable in 100 years, the journey to another star must be ***multigenerational***. Psychologically, the crew's motivation requires that they know the people who will reach the destination: their grandchildren. Assuming that a crew of health young adults departs Earth, they will spend the rest of their lives on the Starship making the voyage. Their grandchildren will be adults when they arrive. This Human Factors parameter puts a practical limit of about 80 years on the voyage (Cohen and Brody, 1991). If the Starship flies to the nearest star, *Proxima Centauri* (assuming it has a habitable planet), 4.22 light years away, the propulsion system must achieve ***0.053c***. In terms of known exoplanets that appear to be in the "Goldilocks" habitable zone, the closest found to date is *Gliese 581c,* which is 20.5 light years distant. Making that trip in 80 years demands a velocity of ***0.26c***.

The Human Factors for this journey dictate several aspects of ensuring the crew's success and well-being. First, the crew must be directly involved in the design of the spacecraft (Cohen, 1990). Second, the design and operation of the spacecraft must fulfill the crew needs, including quality of life, teamwork, and self-realization (Cohen, 2010). Finally, just as the crew needs to be involved in the design of the spacecraft and mission, they must be involved in the development of the artistic, cultural, political, and social, organization of the endeavor.

Non-Profits and NGOs

Currently, many non-profits exist in aerospace, typically engineering societies such as the AIAA or advocacy groups such as the National Space Society. There are fewer INGOs, but they play an important role, most prominently the International Astronautical Federation. Although it is a mix of several constituencies including corporations and engineering societies, the IAF's membership consists primarily of all the world space agencies, giving it a "mini-UN" aspect. For example, the run-up to the 2nd World Space Congress in 2002 was highly contentious, with the IAF conference committee deciding that so-called "national organizations" such as the AIAA Design Engineering Technical Committee could sponsor a symposium as an "associated event," on the condition that it could not appear in the main program. The consequence of the IAF's "house divided against itself" culture was that it was unable to agree to organize the 3rd World Space Congress for 2012. The **lesson** from the IAF is that the iNGO for the 100YSS should be strictly non-governmental, consisting only of non-profits, including engineering and advocacy societies from around the world, and perhaps some universities.

The USIS Model

One such organization exists: the United Societies in Space. The USIS is a non-profit incorporated in Colorado. Its purpose is to build a network and eventually an alliance of space societies that can grow into a system that can provide non-national governance in space. A Starship is exactly the type of venue for which USIS was founded. The initial governance of USIS consisted of a Board of Regents and Council of Advisors drawn from many countries. The initial phase involved the founders appointing the Board and Council members. The following phase that starts this year, builds upon the first 10 years experience, with the goal of eventually having members nominated or elected by the various space societies as representatives to USIS.

The USIS/ISDAC model is designed to support commercial development in space and to provide a system of governance for lunar and planetary bases, expeditions, and ultimately interstellar travel. Let us describe how the model evolved in order to define it.

First, the legal paradigm known as the *common law* needed to become the platform base. From 1066 to 1701 in England *common law* was fashioned in People's Courts, (Church Courts, Castle Courts, and actual Peoples Courts), in order to modify the unfair KINGS LAW into truly fair remedies. For example, the equitable estates of THE TRUST, THE LEASE, THE EASEMENT, and THE MORTGAGE were born as equitable remedies where no legal remedy was possible. These estates sat on the top of other person's legal title, but they did not derogate from that title.

Our reaction was to set up a common law regency trust called The Regency Of United Societies In Space, (ROUSIS), to sit on the treaty-required estate of title to space resources being common ownership of humanity.

Secondly, we filled up the void in outer space law by extending the Common law from England after 1701 to USA; offshore Courts in 1850; then to outer space in 2001 at our Denver Convention. We defined American Common Law as so extended as astro law and as appeared as black letter law in *Corpus Juris Secundum*. This law prevailed until a sovereign state objected or legislated a different law. Property, Contracts, torts, and crimes were covered.

Thirdly, we clarified that ROUSIS was a government, not a nation, and did not claim sovereignty.

Fourthly, we waited 10 years doing research, publishing papers, and appearing at conferences with no objection for those 10 years from anyone to our work.

Fifthly, we then filed a Colorado not-for-profit corporation called "The International Space Development Authority Corporation", (ISDAC), that inherited ROUSIS by way of a type A merger with ROUSIS. This iteration of that model features the ability to issue bonds, the structure to hold a space bank that issues space money, and the legally adequate authority to participate in the benefits and burdens of international law, (much like the Palestinian Authority that also is not a nation). This aspect will subject ISDAC and its affiliates to the burdens of the OST 1967, Article I re no sovereignty, and Article II *re* no space resource appropriation so such resource title is derogated.

ISDAC also maintains a Judiciary and its affiliate space projects that it approves, funds, or initiates, will be required to achieve an advisory opinion from the Chief Judge and the SUPREME COURT of this Authority that it is Treaty compliant. Then the Authority legislature will test that project not only for equitable fairness, but, also, for true benefit to humanity, (as required for satellites due to Article I of the OST 1967), and for engineering and human habitation safety and traditional life styles tolerance before passage and the signature of the President of ISDAC.

This line of thinking will be adopted by, and improved upon, in each approved affiliate project subjected to ISDAC ongoing personal and *in rem* jurisdiction, by agreement and, philosophically at least, on board each 100 year space ship, and its affiliates, tenders, and tugs, attendant to that vessel.

Implementation

Given the foregoing model for organization, self-governance, self-sustainment, and relevance to interstellar travel, the USIS/IDSAC presents advantages as well for the

investment strategy, business model, and other key financial attributes. The USIS model allows the INGO to solicit or borrow private funds and issue private or commercial paper (bonds). The INGO can invest these funds directly in R&D, or in businesses, industries, or securities to create an endowment, the profits from which will support the 100YSS.

With these resources, the International NGO can sponsor or create R&D programs and industries. These programs would target areas where the space agencies may not focus but which are necessary to develop the Starship. The INGO can form private-public partnerships with government agencies to achieve synergistic results. By creating this new fertile environment for space and interstellar R&D with a robust mixture of incremental and long-term goals, the INGO can attract and inspire new generations of space architects, designers, engineers, and scientists. Because government and for-profit corporations will no longer be the sole source of funding for R&D INGO will be able to choose where, with whom, and for what to form partnerships or relationships. This independence will provide strategic leverage for the 100YSS initiative and enable the INGO to develop is own brand and message -- unobscured by the competition for taxpayer funding and the regrettable politics and business development practices that go with it.

Intellectual property, particularly patents pose a peculiar challenge because of the protracted timeline. US patents expire 17 years after award, which is sufficient for ordinary products. Some companies game the USPTO system by continually changing their application or appealing claims rejected or denied, but such a strategy is unrealistic for 100 years, six times longer than the normal patent lifetime. The INGO will create an extra-national patent authority for inventions created, manufactured, and/or used exclusively in space.

Developing the prototypes, test articles, and technology demonstrators leading to the Starship will incentivize researchers. The critical R&D disciplines include fractional lightspeed propulsion, in-space ISRU fuel and manufacturing, radiation protection, regenerative and bioregenerative life support, human factors, the social science dimensions of a multigenerational exploration, and the "universal remedy" of artificial gravity as a hypogravity countermeasures. Depending upon the existing technology development level, the R&D may be basic, applied, focused, or system test, in a lab, relevant, or space environment.

Cohen, Marc M. (1990). Designing Space Habitats for Human Productivity (SAE 901204). *SAE Transactions, Jnl of Aerospace* (vol. 99, sec. 1, part 1, p. 352-364).

Cohen, Marc M.; Brody, Adam R. (1991 April). Human Factors Issues for Interstellar Spacecraft. In, *Proceedings of the 28th Space Congress* (p. 1·19-1·29). Cocoa Beach, Florida, USA, 23-26 April 1991: Canaveral Counsel of Technical Societies.

Cohen, Marc M.; Houk, Paul C. (2010). Framework for a Crew Productivity Figure of Merit for Human Exploration (AIAA 2010-8846). *AIAA Space 2010 Conference and Exposition*, Anaheim CA 30 Aug-2 Sept 2010.

United Societies in Space http://www.angelfire.com/space/usis/