

US Participation and Leadership Potential in Humankind's Migration and Survival Off-Earth: The Myth of Competitive Procurement Benefits

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In a previous White Paper discussion piece, John W. Robinson (2013) stated on behalf of the Space Propulsion Synergy Team (SPST) that numerous factors were forcing off-Earth migration of humankind as a necessity for species survival. A few other disciplined and thoughtful, articulate individuals have presented a compelling case concerning the fact that the day has come for the need to start on deliberate and purposeful migration to near and deep Space for survival of the human species. This will be necessary, since, in the reasonably foreseeable future, human space habitation will be mandatory, either to support the expansion of the human population, or simply to provide new habitation because events have made the Earth no longer habitable for the general population. Roughly ten thousand years ago, approximately five million modern humans occupied Earth. The population has now expanded to seven billion individuals and is rapidly growing. Space migration will take a long time, but it is imperative for humankind species survival ... and the effort already is underway.

New habitats off-Earth in near and deep space will need to be sophisticated and sufficiently Earthlike to allow the habitation, not only of "humanoids", but other descendent life forms from Earth as well. The journal *Space and Evolution* (SPAevo) is among the few sophisticated publications taking the initiative to encourage disciplined and knowledgeable discussions addressing the necessary planning and constructive initial steps for such current and future endeavors.

The undertaking of the work to develop our migration and outbound growth potential will require an enormous amount of effort. It will strain the limits of humankind's mental, physical, social, and financial resources. The United States can, and indeed should, play a critical lead role in this off-Earth migration, because we have the critically necessary moral compass to successfully altruistically carry out the transition in a manner to benefit all mankind. It is critical that we begin to look at how we employ our human resources now to assure that we define and adopt the most productive and efficient practices we can devise to accomplish the work to come. Because we do not know how long the work will take, and also do not know how long we have before it must be completed enough for at least early habitation, it is possible that

the day we must start the purposeful outbound growth has already passed. Nevertheless, the work needs to start in earnest now.

The SPST commentary also then focused on how to enhance, for what clearly must be a global effort, the role of the United States and NASA, i.e., how to reinvigorate/evolve our national will to survive, with NASA as the lead entity. While the U.S. must in fact assume a leadership role if this global effort is to succeed, certain routine functional facts relating to productivity first must be established and assessed in context. An example of areas where national productivity can be dramatically improved, at least in the United States, is provided by way of the following thought exercise. For about the past 100 years, the US federal and state Government agencies have purchased goods and services on the basis of competitive bids. The logic is that competitive bidding will bring out the best prices and the best quality of overall products that suppliers have to offer. It encourages suppliers to be efficient and provide high quality goods and services to enhance price controls and ensure that satisfied customers will rank them highly on future bids. Overall, it is assumed that this process saves the Government money in the general pursuit of procurements.

Many Government agency procurements induce up to a dozen or more companies to engage in the bidding process. By and large these companies are fiscally sound and able to handle the financial responsibilities that would accompany the contract if won. Indeed, regular Government audits validate the fiscal soundness of companies to which contracts will be awarded. These companies fund their marketing, bidding, and contract negotiation expenses out of their overhead pool, as a normal cost of doing business. In large companies the pursuit of large contracts involves very large expenditures. Expenses range from contributions to political supporters to the costs of producing demonstration products, cost sharing of work, and the development of the final formal proposal documents. Smaller companies have costs that are roughly equivalent in proportion to the size of the contracts they seek. Months of work by a company's top engineers, business managers, cost estimators, planners, administrators and the like are organized and brought together to support the proposal effort. Upper level

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company management is often involved, and the flow of contract work already in-process may be disrupted to make the company's best people available. Overall, as much as 15-20% or more of the company overhead may be budgeted for proposal costs. In fact, in the background, a substantial amount of direct charge money may also be spent on the effort. And since the proposals all seek to be responsive to a common bid solicitation document, the proposal work of the several teams is redundant to a large measure.

Generally, for all this effort, only one company (or team) actually wins. Occasionally, the invitation to bid is withdrawn and no contract is awarded at all. The extensive technical, cost estimating, and planning efforts of the losers is essentially lost, except for that small fraction which may show up in later proposals. The combined costs of the technical/marketing/administrative efforts of the losers may approach the value of the contract in question. In effect, the time, talent, and funds of those losing bidders has to a large degree been lost. Perhaps a greater loss is that some real product they could have produced for that same time, talent and cost, has not been produced. For all the losing bidders, the combined total productivity of their entire proposal efforts has been virtually entirely lost.

However, many of Except that since these companies stay in business year after year, continuing with marketing efforts, awaiting the next bidding cycle to seek yet another possible win. The costs of their proposal efforts are buried in overhead costs added on the contracts that they do win. This means that, in the long run, the customer also has paid the costs of the proposal efforts as part of the overall business contracting costs. But for this compensated lost effort of the losing bidders, the customer has received nothing, and the bidders' employees' time and talents that could have produced a useful product or service result has been wasted. This fact diminishes the lifetime product achievements of the individuals as well. Clearly, this avenue of procurement is wasteful to the point of absurdity. Why would any organization adopt such a costly and wasteful business practice? Yet competitive bidding is common in both public and private contracting activities.

A further significant cost element of this practice arises on the purchaser side. A great deal of planning effort goes into the preparation of proposal solicitation documents. Both technical and business personnel participate to assure that solicitation documents lead to fair bidding opportunities for the suppliers, as well as a level competition field for proposal evaluations. Finally a considerable amount of effort goes into the proposal evaluation process to assure that the evaluations result in awards to the most favorable bids.

Again, here as well, the effort is large because of the large number of complex proposals that must be evaluated. Evaluators must have the knowledge and expertise to comprehend and compare the multiple aspects of a dozen or more technically and financially complex proposals in a relatively short time. The proposal solicitation/evaluation cost to the procuring agency is also money that will not be available for direct use on the product itself.

A better approach is needed in which the inherent waste of money, time, and talent of the burdensome competitive bidding process is eliminated. Business as a game in which there is a winner and a host of losers is not an efficient process. An alternative arrangement in which all competent organizations participate at a steady or increasing levels of work, and contribute productively directly to the products and/or services being procured would maximize the output of individuals, teams, and companies at all times. It would also allow the procuring agency to focus on guiding the production and delivery of the product, rather than on seeking to avoid award disputes among bidders and endless contract compliance reviews. In view of the major payoff in productivity that would result from the elimination of competitive bidding, strong moves toward more efficient and productive procurement practices clearly are warranted. How might this be achieved?

This is not an easy question. Virtually the entire procurement process currently revolves around the competitive procurement model. Procurement contracting laws and regulations are the lifeblood of a subculture of legal and financial practitioners on both side of the procurement process. Cost estimating to provide the basis for predicting what bidders are likely to (or should) bid is another costly element of work that does not contribute to the quality or functionality of the final product. Corporate organizations, as well as procuring agencies, are structured to carry out contracts via the competitive procurement practice.

Among several possibilities, one example is where several companies are paid to work in concert with the customer to define and produce a specific product or service item, which the customer will purchase at a known fixed price at a given delivery date. It is wholly the provider's responsibility to make a profit at the contract price. The customer, in most cases, will assure availability of the product in accordance with specifications by buying from two or more suppliers under similar procurements. There is no bidding involved; the price is fixed. The customer evaluates the firm's capabilities and the fitness of the product. The firm may have elected to produce a prototype beforehand to have a reasonable assurance that its product will be purchased, and that it can make a profit.

A second approach would be when the customer develops the detailed design of the product with direct support of firms paid for providing such design services. The design is then provided to qualified “build-to-print” firms to produce the product for a fixed price.

A third approach occurs when a firm designs and constructs a prototype product of its own which is then offered for sale to a range of customers, based on market research and perhaps market testing.

An important element may be that the customer(s) will cease procurements of programs in which an entirely new system must successfully be designed, built, tested, and flown in order for the end objectives of the program or implementing project to be achieved. Instead, for applications other than the Design, Development, Test, and Evaluation (DDT&E) phase of a new system development, the product or service to be provided will be a known item for which production costs and schedules can be proven with reasonable certainty by prototype manufacturing. The operations requirements and costs also will be known and provided in the program planning and budget. No longer will a new system be designed for a new mission with both evolving together and leading eventually to virtually certain cost and schedule over-runs, and frequent program cancellations ... and an inferior product.

Elimination of the bidding process, and of the procurement of systems not yet designed will have several beneficial influences. One immediate influence is that the producing company will know at the outset that it must produce functional hardware. No longer will fanciful designs be considered in the design selection process. Instead the engineers and designers will know that their task is to design products that will work and that will be built and used.

Another factor will be that designs will be built for durability and having the basic configurations amenable for evolutionary development. New designs will incorporate proven technology, where practical. Design margins will be larger and extended use will wring out flaws and weaknesses, leading to highly reliable systems. Extended familiarity with the details of operations will bring technicians to a high level of skill and expertise with the hardware and its operation. These effects will bring further reductions in risks and costs.

Clearly the implementation of a new procurement philosophy is far more complex than the primitive examples above have illuminated. New procurement structures and practices will require time and intent to evolve. Individuals and groups experienced in all phases of business, such as extant in the SPST, Aerospace Technology Working Group (ATWG), and *Space and Evolution* and associated contributors, as

well as those in many firms large and small may offer compelling suggestions.

The improved procurement approach can probably best be implemented as part of an overall long range guide for the human (and companion species) migration mission. It is clear that such a guide will be mandatory if a continuation of the meandering, disjointed path that has marked the entire Space endeavor of the worldwide Space community is to be avoided.

The nature of the effort required for off-Earth habitation evolution is such that the cost will be too high and take far too long for depending entirely on outside (i.e., Government) funding. The work, for the most part, must be self-supporting. With this in mind, the plan must provide for each step to produce revenue. For example, the first step could be a fleet of sub-orbital Half-around Rocket Planes (HARP) and their flight support infrastructure, carrying cargo and passengers any place on the globe within two hours of liftoff, the short block times of HARP fleets will generate substantial revenue. This money will support the continuation of the habitation program. The next step could be construction of fleets of launch vehicles and their flight infrastructures, providing delivery of cargo to Earth orbit to support the construction of the Earth orbit commercial infrastructure. Cargo delivery capability of the launch fleets could range from about 1000 kg to 150,000kg. The earning capacities of the launch fleets and the subsequent orbiting industrially productive infrastructure would provide the cash flow for outreach to the Earth’s Moon, Venus, Mars, and other destinations and also potentially for mining asteroids. The point here is simply that the funding for the endeavor can and should be earned by the operations, instead of looking to some Government agency to finance the work. The program must be planned to be revenue producing and economically viable if it is to have a chance of succeeding. It cannot be a net drain on a nation’s cash. Also, in this manner, ongoing funding is under the management of the operation, instead of having to respond to the vagaries, whims, and frequently irrelevant governmental politics.

It is of interest to observe that the U.S. has the ability to accomplish all of the above steps with technologies currently in hand. Technologies that will inevitably evolve with ongoing Space exploration, migration, and settlement will only enhance the technical work and make it yet easier for financial soundness to be sustained. It is to be hoped that the U.S. can outpace the evolution of humankind, to its humanoid descendants, as well as plant and animal companions, as our nation and its international/global collaborative colleagues build the hardware for these early and relatively primitive migratory steps outward. How-

ever, having ones house in order and generating funds efficiently and effectively will be powerful incentive to encourage humankind's evolution and survival as well. Critical aspects for accomplishing these objectives will require careful and realistic consideration of the social, fiscal, and legal issues involved ... both in the U.S. and with and among its global collaborators.

In a followup article I will consider social, financial and legal issues relating to the above. All are invited to provide inputs, be they critiques or suggestions. Followup articles by others will be especially helpful in elaborating exactly how complex all these issues are.

Literature Cited

Robinson, J.W. 2013. The Justification for Human Space Development and Habitation Beyond Low Earth Orbit: An Invitation for an Open National and Global Dialogue. *Space and Evolution* 2013:1-2.