

# ***Endurance***

**Persistence is Everything**

**The 100 Year Starship**

## **Response to Request for Information**

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## **Introduction**

The Endurance Project is pleased to provide this response to the questions posed in the Request for Information (RFI) issued by the Defense Advanced Research Projects Agency (DARPA). The Endurance Project is an aspiring non-profit group in New Mexico, U.S.A., that formed in 2008. The purpose was to organize the world's technologies and promote interest in science and engineering in order to construct and maintain the first large-scale interplanetary spaceship. Still in its infancy, The Endurance Project understands that such a project will require exceptional planning over generations to achieve such an ambitious goal and has spent the years since its inception attempting to solve the very problems posed in this RFI.

## **Questions**

DARPA has requested detailed information regarding how organizations evolve and maintain focus and momentum for 100 years or more, what models have supported long-term technology development, and what resources and financial structures have initiated and sustained prior settlements of "new worlds". Respondents have been requested to provide a description of a proposed organization and approach for the establishment and operation of the 100 Year Starship™ research entity.

## **Exploration in the Past**

Structures that have sustained exploration in the past have been loosely based on the need for new resources and overpopulation as was the case of the first explorers to leave Africa and spread into Europe, Asia, and the Americas. Generations later, the next people to explore the Americas had the financial backing of a country or organization's leadership. These voyages were motivated by greed and paid for by the monarchs of Europe.

We, as a people, seem poised to repeat such a support structure into the solar system, either by habit or by necessity, but this is not the only method available to us. While greed is a powerful motivator, the need to explore can be just as powerful. It is the opinion of this organization that the need to climb the mountain because it is there can be just as powerful. If given the resources, humanity will push into the great unknown out of curiosity if nothing else. It is this very reason that took many colonists to their destination. At their heart, they were explorers seeking a better life.

## **Organizational Structure**

To be as productive and innovative as possible, any organization that intends to last a century without periodic mass reorganization needs to be as flat as possible and embrace regular shuffling of workers within the organization. There should be no more than three tiers across the entire organization. The sub-groups should be as nimble as possible so that workers communicate outside their group.

The leader of the organization should always be accessible, never intimidating to anyone at any

level, and have a group of direct reports that manage the day-to-day business of the company. The leader's role is to provide long-term guidance, not micromanage. He or she must trust that their direct reports structure their objectives to meet the long-term goals.

The ideal size for such an organization is approximately 250 central employees. Any fewer and projects will take too long to complete, and any larger and the leader of the organization becomes a figurehead and is no longer accessible to each employee. Access to the leader and his direct reports is critical in an innovative company because new, and often revolutionary ideas, are too easily strangled in the very committees designed to hear them. Ideas need to flow freely throughout the organization. Once well-developed, construction of the ship can be paid for by the company, but performed by external contractors working with the company.

### **Governance Mechanism**

Jim Collins discusses in-depth the difference between what he calls "Time Tellers" and "Clock Builders" in his book *Built to Last* (1997). He postulates that if a company is to outlast its founder, he or she cannot tell people what to do and how to do it. They cannot micromanage, but must instead build an internal mechanism from which the company will operate long after they have gone. The difference is subtle, but critical. Where some companies flounder or worse fall apart after their founder moves on, other companies continue to thrive. They thrive because they keep the founders message close to heart, but are not dependant on them for day-to-day decisions. The organization needs to behave more like a country than like a corporation. An example of this "clock building" in action is the United States Constitution. The founding fathers set into place a mechanism that would live on far after they were gone. They were clock builders, not time tellers. Dictatorships are often founded by charismatic leaders, but cannot stand the test of time like a constitution-based country.

The selection of future leaders of the organization is just as critical as the personality of its founder. Potential leaders should be homegrown and not brought in from the outside. The best leaders know all levels of the business. They have worked their way up from the bottom and understand not only the theory of business, but the practicality of running a business from all levels of management. Most importantly, the founder and their successors cannot be in the business for the glory. They have to do it because they have an inner calling for it, a passion that transcends fame and fortune. Managers must understand the future of the business and how their actions play into the bigger picture of the organization.

### **Investment Strategy and Criteria**

Building a spaceship is in no way a cheap or quick prospect. By its very nature, it is a long, expensive process with few short-term rewards. The International Space Station alone has cost an estimated \$100 billion U.S. Dollars and took the combined effort of 22 countries over 15 years (U.S. G.A.O, 1998). A standard business model would call for the company to use its start-up funds to create some worthwhile product that would allow it to make an overall profit in order to grow. While this is a common and practical approach, it is inherently risky because the organization must jump into an industry and produce a quality product like any new business.

To last one-hundred years and beyond as an independent research and development entity, the proposed organization cannot count on yearly external government funding nor can it always depend on making a profit from its products. There is too much uncertainty to count on a standard business model. An overlooked alternative is to fund the organization with a large sum of money from which it would survive indefinitely, without the need to provide a worthwhile product from day one. This “Lump Sum” approach eliminates the uncertainty of an unstable federal budget, or bad sales year, and ensures that the company will survive well into the future.

By funding a single large initial sum of money, which will only be used to generate interest to fund the company’s day-to-day operations, DARPA can assure that the proposed 100 Year Starship organization will last indefinitely. Investments will be made in safe, stable markets like Government bonds and certificate deposits, which fluctuate with the global economy, but are safer than the stock market. This “Lump Sum” model more closely matches a retirement plan or a scholarship fund than a business plan. The reason this is not done in industry is because of the high start-up cost. Companies need too much money for this to be worthwhile. DARPA however, is in the unique position to start a company in this manner.

To sustain itself in this manner, the organization would need an estimated initial sum of over \$100 Million U.S. Dollars at 1.5% interest. This sum would be sufficient to pay salaries, benefits, taxes, and debts, and still create a large return on investment. Calculating the yearly revenue generated by the company, accounting for a cost of \$75,000 per head, the number of possible employees and yearly cash can be seen in the figure below.

	\$100 Million Over a decade	\$200 Million Upfront	\$1 Billion Upfront
Initial Head Count	1 Employee	10 Employees	50 Employees

(Figures do not account for inflation and taxes. Additional Information available upon request.)

The organization would be non-profit with fixed salaries for both the employees and upper management. Any amount of money not spent would be returned to the primary fund at the end of the fiscal year. The ultimate benefit of this alternative is its ability to outlast government organizations, presidents, and the up-and-down cycles of industries. It would allow the organization to work independently of the outside world so that it can get down to the business of developing technologies and designing a spaceship without the continual worry of where its funds will come from the next year. Many of the technologies required for effective space travel are also needed here on Earth. Technologies such as safe non-fossil fuel power generation, water purification, efficient food growth, and more could be developed and sold to generate additional revenue for the organization.

### **Long-Term Business Model for Self-Sustainment**

An organization that is going to last over the span of a century or more is going to require something more than just incentives and meaningless mission-statements. It is going to require

heart, a commitment to its own cause and an intrinsic purpose. There must be a reason for existing beyond the need to produce a product and make money.

According to *Built to Last* (1997), organizations that last have a purpose, and a broad sweeping ideology that transcends what they do and the desire to generate profit for the sake of profit. Any kind of hundred-year organization must support this ideal if it is to survive. While profit is essential to the survival of any business, if that is all there is to that organization, there is no soul, and thus no desire to push the boundaries and better itself and its community. Each worker needs to see the big picture. Many people work only for the paycheck. In an ideal organization, workers need to believe in the product and want to be there to better the company's purpose. A worker who can see the big picture, and their place in it, is more valuable than someone who cannot. Workers need to be chosen who understand what part they are playing in the grand scheme of things so they can perform their job effectively.

## **Discussion**

The future is up to us. We must build the future we want to live in, and there is no better time than right now. It will not be easy, but nothing worthwhile is ever easy. There will always be those who will say that the money could be better spent here on Earth, that we could cure diseases and solve world hunger. They will argue that we should solve the problems here before we explore space, but this is shortsighted. Where we go is not nearly as important as what we learn along the way. It is very likely that in our quest to voyage to the planets, we will solve problems on our planet. Numerous technological and social breakthroughs have occurred as a result of our space voyages. The miniaturization of computers, water treatment, and space-based weather prediction are all a result of our exploration of low Earth orbit. The possibilities for more technological breakthroughs while exploring the outer reaches of the solar system are unimaginable. We will not know unless we try. Explorers of the past did not know what they were getting into by setting out into the bold unknown. The money for Columbus's "shortcut" to the Far East definitely could have been better spent in war-torn Europe, but because he dared to do the impossible, a whole new world was discovered. That was a discovery worth the effort.

## **References**

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