JoAPM Editorial

A Brief History of Rocketry and the Emergence of Civil Space Organizations, the Good and Ugly

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How We Arrived in the Space Environment

For as long as the space program has existed the preferred method to reach Earth orbit and beyond has been utilizing evolved methods of rocket propulsion. Although rocket technology has a long and established history dating as far back as 600 A.D. for Chinese fireworks displays, it did not receive the proper majority level to achieve the brute power and force required for space flight until the mid 20th century thanks largely in part by the efforts spearheaded by Dr. Wernher von Braun (1912-1977) and many other visionaries. Amazingly enough earlier visionaries such as Robert Goddard (1882-1945) whom advocated the use of rocket technology for space travel before such an idea was largely accepted by the public were largely ignored if not all together ridiculed, as the idea of space travel seemed to radical for the cultures of the past, demonstrating a missed opportunity for taking steps towards human space flight for at least a century according to written records.

The slow acceptance to societal uses of rocketry however abruptly ended by the paths pursued by several world nations interest in the possibility that such new technologies could allow for dominating war faring capabilities for the procurement of their self determined national interests. World events continued to bring life into future space based technologies, most notably by the appearance of the German V-2 rocket (1940-1945) used for long range devastating attacks against the nation of Britain. The end of World War II (1939-1945) brought new revolutionary advances in science and technology, and after demonstrating the destructive powers possible by the fission of atomic elements by the loss of countless lives in two major Japanese cities also further served the pursuit of national rocketry interest as a means of achieving dominating military objectives. Rocketry offered a means of delivery for large scaled atomic warfare onto unsuspecting locations with complete military superiority; such terrifying prospects soon became realized by the launch of a small unassuming manufactured satellite named Sputnik 1 from the Soviet Union in 1957.

The launch of Sputnik fueled a quest for orbital military dominance by the United States and the Soviet Union. This was a direct consequence of the Cold War (1945-1991) political environment and the threat of complete destruction of any civilization engaged in an atomic conflict. The quest to have a dominating military presence in space was to become known as the Space Race by the general populous, fearing the consequences of an atomic conflict the Limited Nuclear Test Ban Treaty (LNTBT) was signed in 1963, which banned the launch of orbital atomic weaponry (although prior to this treaty a number of nuclear devices were tested in the orbital space environment) as well as other forms of atomic weapon testing. The LNLTB was signed by the participating nations of the United States, the Union of Soviet Socialist Republic, and the United Kingdom. Since the US and the USSR were uneasy about any potential space based conflict and they both put a lot of effort and resources into keeping neck and neck with each other's capabilities

to assure no military dominance in Earth orbit. The national moves and countermoves in the space environment were also directly responsible for the creation of the civil and nationally regularized space programs known today (e.g. The largest being NASA and the RSA), which even began to spawn seedling cooperation between the space fairing nations even if politically isolated. Ultimately the United States won out in the Space Race with the landing of the Apollo 11 spacecraft on the Moon in 1969, these events lead directly to humankind's current cultural presence within the space environment.

The purpose of discussing the very brief origins of rocketry propulsion above was to illustrate a number of good intentions for the use of rocketry from entertainment to peaceful space exploration. The reality of the situation however was that while that it was early on conceivable that some reactionary technology could place an object into orbit only a few even considered it a workable possibility yielding essentially no progress aside from a few people's passionate curiosities. However it was quickly realized that reactionary systems could allow for the transportation of explosive devices, which could affect the outcome of armed conflicts, so the ideas of rocketry were developed further to achieve such goals. Overall it has generally been our innate behavior as a race to expand our boundaries and to control them in a manner of our choosing that has resulted in our current presence in space. One could very easily argue that our current presence in space has nothing to do with improving the quality of life, to acquire knowledge for the good of humanity or any of the other worthwhile goals we may wish to attribute to it. More appropriately our presence in space could be written off as an accident driven by nothing more than our internal conflicts and resolutions. We as a race never had any true intent to venture into space; it was simply our political and social differences, which forced it upon us. However at this point in history we are quite aware that we can travel into space and that our resources are limited to our planetary confines as well as the survival of our species. To grow and survive as a species, will no doubt require a continuing human presence within space, the questions, which face us now, are: will we ever be ready to make the next big leap, and are we truly capable of making the next big leap?

Rise of Civil Space Organizations

The next big step in the human quest to reach the stars was to dissolve our political differences and band together for one common purpose, our mutual survival. The Cold War mentality left the political world with a omniscient chill overhanging above our skies as a consequence of the global stalemate imposed by the prospects of our Mutually Assured Destruction (MAD) should a nuclear conflict arise. Nuclear weapons technology development however continued within the US and USSR, by the manufacture of long ranged Intercontinental Ballistic Missiles (ICBMs) along with their countermeasures. The disturbing emergence of ground based nuclear weapons launches were sought as a measure of side stepping the 1963 LNTBT and marking a step backwards for the new found cooperation between the space fairing nations resulting in the resurgence of local political ambitions and their conflicts. Surprisingly no concrete plans were developed as counterweight for the ever present MAD reality of armed conflicts, a counterweight which we will term Mutually Assured Survival Strategies (MASS), something which should have logically seemed to be the next big global political realization, however such far reaching policy mandates are completely alien to the operations of national governments. From an operational perspective the policy of any and all nations is to protect themselves and their inhabitants, by their very nature they are not organized for mutually assured protection but for the lesser biological evolved strategy of self-preservation. Despite the worlds

continuing political ambitions, internal conflicts, and self interest no atomic weaponry have found their way to permanent earth orbit poised to fall from the sky by the touch of a button.

In general it has been a number of brave political and military leaders that have been put into the position of maintaining some bare minimal MASS policies to act as a diffusion mechanism should a critical MAD situation come to rise. The military to date has had a long and continuing presence in the space environment and often separate from the civil program, fortunately such military roles is space have been limited to collecting, transmitting, and possibly interfering with information data within space (on the other hand it should not be forgotten that defensive orbital bodies objects may be placed into orbit). Amazingly however the crude and purely superficial MASS policy that has been playing out for the moment has succeeded at putting the space environment off limits as a battlefield for terrestrial based conflicts. In fact the military role in space in principle is not fundamentally different from the civilian role in space, being to collect and analyze data albeit for different purposes.

Governmental powers wanting to have a continued human presence in space and to alleviate any potential orbital based armed conflict collectively began to form the civil space organizations. The first space civil organizations to make their appearances originate from the US and USSR with little surprise from their dueling Cold War behavior. The two original space organizations became know as the Russian Space Agency (RSA) for the now defunct USSR government and the National Aeronautics and Space Administration (NASA) based in the United States. The RSA has a bit of a cloudy nature due to the behavior and policies of its based government, although what is known readily is some of their technological capabilities and missions they have flown into space. So the civil stroll through the space story will now follow the creation of the NASA organization as ordered by the US Congress. The National Aeronautics and Space Act of 1958 (the Act), 42 United States Code (U. S. C.) 2451 mandated NASA with the plain and clear purpose *to collect and analyze aeronautical and astronomical data and to dispense that information to the public*. Its mandate was never "to put on man on the surface of the Moon and to return him safely to the surface of the Earth." It was simply to collect data by methods allowed by committee and government funding and this information was to be distributed to other organizations freely as they saw fit. The larger often awe inspiring NASA objectives people assume to this date are in fact far from the mandate of NASA, the “Moon and Beyond” mentality was simply the technological superiority showboating carry over from the Cold War geopolitical environment.

Some NASA programs were formed with funding and lobbying by the US Air Force (Heppenheimer 1991) to support its activities (although historically it would fail to live up to these expectations), as such NASA's early efforts were made possible by military research labs such as Wallops Station (Wallace Jr. 1997), which performed a number of activities including the development of ICBMs. The Wallops Station operation was dismantled (or rather reorganized) in favor of an open space organization and with the hopes of alleviating nuclear tensions at the time and was ultimately responsible for producing the Mercury-Atlas launch vehicle. As NASA grew it also became concerned about how to teach principles of propulsion, and the nature of the space environment to the public in general giving birth to a truly civil based space organization. While doing so NASA was awarded funding and contracts to compete with the rivaling USSR Space Program, which was leaps and bounds ahead of NASA and more willing to consider more "experimental" applications for rapid progress in their activities. This lead to the USSR

putting the first man (Yuri Gagarin) into space, the longest flights in space, and many other advances, meanwhile the US space program was placed into a mode of constant "catch up" in the Space Race. Still the two national agencies actually began a series of cooperative flights, perhaps most notable being the Soyuz-Apollo space docking in 1975. In November 1969 the USSR may have attempted the first manned lunar landing, although an unknown explosion occurred in their launch vehicle, the history is a bit speculative here but worth noting. NASA continued to run its missions with its "keep it save" policy and with exponential funding led to first human presence on an extraterrestrial body by American Astronaut Neil Armstrong on July 20, 1969. Soon afterwards the civil population would loose interest in space exploration, and a number of civil issues and political instabilities would see drastic cuts to the space program. The USSR would continue with on with Space Station program from 1971-2001 until the fall of the Mir (1986-2001) program, and also launched a number of interplanetary probes to explore the solar system. The United States would try to catch up by launching their own space station known as Skylab (1973-1974), although funding problems forced its inevitable destruction upon reentry in 1979, from there on NASA would focus on its Shuttle Program (1981-present) and its unmanned interplanetary probe missions. Later the Russians would attempt to run a shuttle program of their own and then suddenly lost funding, due to a number of governmental and civil reforms. The NASA shuttle program would remain the largest civil based operation, until the time of this writing.

RSA, NASA and other emerging space organization such as the European Space Agency (ESA) and the Japanese Space Agency (JSA) to name of few began to make their presence known in the world circle. The larger goal of the collective civil organizations as a whole was to establish an International Space Station (ISS) which is still under construction and running into problems due to a number of failings with the US Shuttle Program and the serious lack of support required for the maintenance and growth required by such long term and challenging space missions. Over time we as a people have been witness to a larger and more cooperative international presence within the space environment, and we've also been witness to larger civilian input into the operations of space-based organizations. We have also been witness to a lack of general concern for the space program, resulting in drastic cuts to the space program down to the point where such programs can barely maintain existing infrastructure as well as facing many challenges in keeping them operational, which of course falls far short of visions required to make revolutionary new breakthroughs. Clearly a disturbing trend has been sent into motion, being the degeneration of the worlds civil space programs, even though the opportunity to make radical advances is present the support for them is not. The world is now at a critical junction in terms of the existence of its civil space programs, the questions that remains now is what do they mean to us, and what are they worth to us. From the brief history discussed above it can be clearly be seen that the space program is anything but trivial and has world wide importance in one form or another. Will we miss another step into space flight history, will we fall back to our ways of distrust and petty concerns, or can we grow, what is clear however the decisions we make now will affect generations to come, the real question however is what legacy we will leave (MAD or MASS)?

Uncertainties in 21st Century Space Flight and Beyond

It is often asked why we go into space, often it is generalize to "we have problems down here and do not need to consider problems out there." For politicians it is often stated

that funding would be better spent on social issues than on space flight issues, let us consider the first question. We go to space because it is there, we know its there, we know how to get there, and we want to learn about there so that we can learn about ourselves and grow. It is also important to learn about the space environment and Earth because they are where we live, we must understand our environment to both grow and to survive, in short it is our nature as human beings to grow and to survive and that is why we journey into space. The second question is that we have problems down here on the ground, long story short that is a correct assertion, but it has always been that way at least the whole of written history. Furthermore, there are problems out there. Scientists strongly suspect that an impact with a large body caused, at least, one mass extinction(if not more) on the Earth. Within the last decade an observed astronomical collision of Shoemaker Levy 9 into the Jovian atmosphere in 1994 (resulting in megatons of TNT explosive force, with plume sizes exceeding the Earth's radius), which can leave no question that space bodies pose a direct threat to our very survival. Further still some of the problems up there in space, such as the threat of global nuclear war were put there by us, to say that we don't have problems out there is just non sense, at least one big threat we put there ourselves willingly. The least we could do is put up some checks and balances to make sure the space environment is free of hazards so that we can focus on dealing with social problems concerning the life's of our citizens, ignoring one big problem for another simply does not help either issue.

As for spending issues there exist what are known as "black budgets" in government spending which have neither congressional or civilian oversight and those budgets are far bigger than NASA's at least for the US and the general public has no idea where that funding goes or what it is used for (at least there is control over the funding and operations of the civil space program). An estimation of black budget spending by the US Pentagon in 2003 was approximated to be 23.2 billion dollars as reported by the Portland Independent Media Center. While in 2001 NASA's human space flight budget was given 5.4 billion dollars, and since NASA's budget is overall less than 1% of the National Budget with education consuming about 2% (or nearly $11 Billion), if politicians are going to mention funding issues why doesn't this rather large discrepancy ever get brought up or the ethics of such decisions? So I would disagree that NASA budget is damaging our society in a means, which is not all ready integrated with current governmental procedures. Aside from the first question addressed in this section all deal with political strategies and concerns and do not actually address why we go into space. If you think humankind should not grow, and should not take steps to protect ourselves form potential threats, then we probably should not go into space, but I doubt any sane person would openly agree with such reasoning. Again how and what we do with the space program is up to us, knowing the facts about its operation can allows us to shape its future as well as our own.

So what is the future of the space program, does it have a future, these are questions that we must address now if we are to assure its survival. Current schemes include revolutionary ideas of the 1960's, being establishing a permanent lunar base, constructing space station facilities and possible trips to our next survivable rocky planetary surface, Mars (Logsdon 1995). One of the many oversights into these plans is the realization of cost for these programs, you must have life support systems, construction periods, research and development and lots of funding and support (most notably **public support**). It seems that the current space programs lacks these visions of what the space program should be about, and one thing that is often neglected is that at

least in the US, is that vision of the `Moon and Beyond' are not the policies of NASA. This is because NASA can be thought up rather crudely as a space division of the US Geological Survey (USGS), yes they have some vehicles, from which they collect data and share it. But putting humans on the face of Mars is no more NASA mission than building underground cities is for the USGS, such a mandate would have to come from Congress and ultimately from the public. It is also clear that if the human exploration of space is to continue that we must come up with radical new ideas of how to survive in space, work, and travel within space. Currently NASA activities include the first two, but funding remains a problem and we could soon see the collapse of those programs relying on nothing more than the often notoriously difficult robotic missions throughout our planetary system. One of the most promising programs to look into the feasibility of new propulsion ideas (such as the recently coined "field propulsion" concepts) such as investigated by NASA's Breakthrough Propulsion Physics (BPP) has been recently cut due to a lack of civil and political interest [even though its mandate was to explore new propulsion ideas such as the newly tested ion based propulsion systems, and this was part of NASA's early doctrine also (Logsdon 1995), it is also worth noting the European equivalent of BPP is still operational, project Greenglow]. Although clearly rocketry has a number of limitation (Harje and Rurdon 1972) even trips to Mars and beyond often in vision modification of rocket technology such as the incorporation of nuclear reactors to cut down on travel periods to distant bodies (Connors 1971). Cutting programs like BPP while attempting to explore deep space is like cutting funding for a longer lasting light bulb for cave exploration, you are only going to get so far before you have to come back again, and we have all ready seen this pattern once in our quest to search the heavens.

Lastly we will comment on some issues of recent history, it has recently been suggested by presidential mandate that the Shuttle Program be dismantled after the completion of ISS. What is interesting is a bit of history. In the US there are essentially three governmental branches responsible for civil space policy, the White House, Congress, and the Office of Management and Budget (OMB). The OMB is perhaps the largest group that has considerable influence over the program. In fact, the shuttle program was given a reduced budget **twice** by OMB, stating the NASA could do things cheaper, and after an initial reduction for a sound engineering vehicle (yes cheaper, not safer, not better, **cheaper**). In order to maintain crewed space programs NASA had to give into OMB demands just to keep `peopled' space flight operations running (Heppenheimer 1991), that was the high price of the US had to pay for its crewed space program, which we would find later. These are the kinds of situations NASA is forced battle against time and time just to maintain an operational space program, while other parties continue to downsize the organization for their own personal gains. Unfortunately this leads towards a dark segue into the loss of the Columbia shuttle vehicle upon reentry on February 1st, 2003, NASA was operating not the best shuttle possible, but the least expensive one the government or OMB was willing to fund. This lead to a number of NASA specified components to be built by subcontracting many systems, and the subcontractors are essentially responsible for (NHB 5300.4 1979). This compartmentalization could be seen responsible for the failure of the wing system of the space shuttle as no one was accountable for assuring component safety for probabilistic high velocity debris impact. The subcontractors only had to worry about flight stress and stress failure, not want might actually happen upon realistic launch conditions, as such the construction of the shuttle did not have to be designed with real world flight scenarios in mind. As such NASA has to assume the role of safety inspector without knowing the

full range of flight stresses component parts can fair safely, from the restrictions discussed earlier and the isolated compartmentalization of the system *causes the whole system to fail,* as such the finger can only be pointed at the system (no which hunting required). Having shuttles who's optimized designs were degraded twice for funding issues (Heppenheimer 1991), added to the fact it was an outdated concept prior to its launch (but not when it was first envisioned, in other words a case a form prior to function), along with isolated compartmentalized design parameters required by the initial restraints placed by OMB all tied together can clearly be seen as an avenue to disaster, in the end you get what you pay for or don't.

Today there are plans to build permanent lunar station, the construction of permanent space stations and trips to Mars, even though such plans have been explored in the past (Logsdon 1995). Can we learn of the operations of the civil space programs of the past to prevent a repeat of history with yet another false promise? Today there is something being done by the public to protect a space program they have come to admire, the Hubble Space Telescope Program (1990-present), an orbital telescope providing breathtaking photographs of the distant and local cosmos. Citing concerns with the Shuttle Program NASA has decided to cancel a 2006 Hubble servicing mission, which will likely mean the end of the HST program. Although many are puzzled by this and are considering private funding and international help to save the program, a clear sign the civil space program is for the people and ultimately controlled by the common citizen, and that they can take action in shaping it. It is not up to the government to decide the future of the civil space program, it is up to the people who support it. Hopefully the fight to save Hubble will set a president for the future direction of the civil space program, either that or political antics will further aid in its present mutilation. So will our present space program fall away and our world disintegrate into the spiraling world of MAD or will a new era for MASS be introduced establishing a new chapter in human history, the choice is up to us and only we can make the change we want to see.

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