NATIONAL INVESTMENT IN BROAD BASED TECHNOLOGY RESEARCH AND DEVELOPMENT AS A MEANS TO DECREASE INFLATION, AND INCREASE EMPLOYMENT.

In the 1960s, America invested in an effort to place a man on the Moon. This effort resulted in substantial benefits to the nation's economy. A substantially increased budget investment in openning up the space frontier can have a similar impact on our nation's economic future.

Investment in space and other broad based research and development efforts, doesn't have to be limited to federal tax dollar investment. The chief handicap of relying on the federal government, is that it takes from five to ten years to see significant results. Congress and the President prefer solutions that will take place within their terms of office. Corporate investment in Apollo type programs could be substantially increased, through government incentives, such as property rights in space, tax credits for research and development, and federal risk insurance for new unproven technology. Of course, a corporation could prove a technical concept worthy of such insurance through solid science, experimentation, and marketing research. If a real potential is there for a major breakthrough, it will be worth investing in.

To maximize return on investment, space transportation costs would have to be brought down radically. NASA breakthrough propulsion research, and various independant researchers have shown a real potential in this area. Cheap access to space would open up manufacturing and colonization possibilities. The use of outer space resources would further drive down space development costs, while increasing markets for both space mining, and space manufacturing. Mankind would establish bases throughout the solar system, and possibly go to the stars. There are some loopholes in physics which may make star travel possible at acceptable energies, and at acceptable transit speeds. These would all be direct benefits to the public.

Some people argue why invest in major technology advancement to get spinoffs (derived benefits) when we can invest in less expensive specific projects to find specific solutions, to specific problems. For example, why rely on the space program for medical advancements, when we could directly invest the money into medical research. This approach does get some results, but it tends also to be limited by the problem of fixation of purpose. With broad based technological advancement, problems are approached from new angles, to bring about otherwise unforeseen results. This approach increases innovative thinking, and major breakthroughs. This is what is referred to as cutting edge technology. Electronics engineers were perfectly satisfied with vacuum tubes, before intigrated circuits were developed to help put man on the Moon.

TERMS:

Fixation Of Purpose: Limits to innovation due to a standard approach to a standard problem. Also, innovation limited by a standard routine. Not being able to view a possible new development possible from an unexpected angle or approach. ICs and penicillin were discovered from previously unforeseen angles, that found previously unforeseen practical applications. The IC was developed to solve a problem in spaceflight applications, but found practical applications in the electronics industry.

Aggregate: A number of non-related characteristics that share common interests. Economic trends are an example. The parts are not directly related to each other, yet common interests by a majority, creates a trend.

Macroeconomics: The study of economic projections that affect the nation as a whole, based on aggregate functions.

Think Tank: An information research organization. In this case an information research organization that studies aerospace industry markets, and related economics.

To prove the value of enlarging the national economy through derived spinoffs, there have been a number of economic research studies that have shown the impact in this area.

QUOTATION FROM WERHNER VON BRAUN SPEECH AT BYU, GIVEN IN WINTER OR SPRING OF 1971

"In the first decade of the space age, we saw our gross national product, (that is the sum total of all products delivered, and all services rendered) grow from $460 Billion, in 1960, to more than $900 Billion in 1970. Today (1971) it has reached a $trillion. Approximately half of the real growth of this gross national product, say the economists, can be attributed directly to the stimulus of new technological knowledge from research and development investments. 25% of this country's total research and development expeditures was invested in our Space Program."

"People who complain about spending on space, seem not to realize that as an earthbound activity, NASA has generated more than $40 Billion in goods and services over the twelve fiscal years between 1959 and 1970. All of this money was not spent, as so many people seem to make us believe, on the Moon. It was rather returned to the economy as wages and salaries to an average of 250,000 people a year. More than 90% of the spending on space funds went to 20,000 industrial and business firms in thirty states, and 177 cities in the United States."

"This spending contributed to advanced development in new industrial products: in computers; process control; a new form of communication by satellite, and advanced weature observation; new materials; greater mechanization; and better management techniques. One important development, is the growth of the computer industry, primarily as a result of NASA's requirements in its spaceflight programs. This industry now (1971) provides gainful employment for 800,000 Americans. These are now, the activities that will pay for the programs needed to improve the quality of life. The worst folly we could commit, is to stop investing in creative programs of research and development, which stimulates the growth of new enterprise and new jobs".

1973 STANFORD RESEARCH INSTITUTE REPORT

In the early 70s, each NASA research center, had an office of technology utilization and industrial affairs. Out of these offices came technology application teams to deal with the general transfer of space developed technology to industry. The biomedical application team was dedicated to that field of application alone, which was significant. The Standford Research Institute estimated that the public was receiving $7 worth of technological benefits for every dollar spent on project Apollo. Former senator Jake Garn, more recently stated that the current benefits are worth $9 for every dollar that has been spent over the years on the Space Program.

1975 CHASE ECONOMETRICS INC. STUDY

Chase econometrics, of Bala Cynwyd, Pennsylvania, did projections on the impact of increased NASA research and development funding on the national economy. The NASA printout states, "The methodology and results revolve around the interrelationship existing between demand and supply effects of increased research and development spending, in particular, NASA research and development spending. The INFORUM Inter-Industry Forecasting Model is used to measure the short-run economic impact of alternative levels of NASA expenditures for 1975. An aggregate production function approach is used to develop the data series necessary to measure the impact of NASA research and development spending, and other determinants of technological progress, on the rate of growth in productivity of the U.S. economy. The measured relationship between NASA research and development spending and technological progress is stimulated in the Chase Macroeconometric Model to measure the immediate, and long-run economic impact of increased NASA research and development spending over a sustained period. 134 pages, unclassified document."

The study concluded a significant effect on the nation's economic activity wouldn't occur until after the fifth year of increased expenditure. The study concluded that a $1Billion increase in 1975 NASA R&D spending, sustained over ten years, would have resulted in the creation of 1.1 Million new jobs (mostly private sector), a reduced national rate of inflation of 2%, and an increase in the U.S. Gross National Product of $23 Billion, sustained into the future.

It appears self evident that an investment of several billion dollars more, in broad technology base research and development would provide substantially better results after ten years and beyond.

1986 - 1988 BEN BOVA ARTICLES IN SPACE WORLD MAGAZINE

In the early years of the National Space Institute and L5 Society merger into the National Space Society, Ben Bova, the President of NSS gave some interesting articles on the economic impact of the Space Program on the U.S. economy. These articles appeared in the president's message section, in the March 86, September 86, April 87, July 87, September 87, and June 88 issues of Space World magazine. Ben Bova stated to David Baxter, that he took a survey of American's top ten corporations, and estimated how much money they were making as a result of space derived technologies, he was aware of.

In the articles, he stated that space derived technologies were pumping $500 Billion per year into the American economy, and supporting over 10 Million jobs. The areas of technology surveyed included communications, energy, electronics, and new materials.

1989 CHAPMAN RESEARCH GROUP REPORT

The Chapman Research Group is located in Littleton, Colorado. The report studied the economic impact 259 non-space applications of space derived technology between 1976 and 1984. The study represented about 1 % of the estimated 25,000 to 30,000 Space Program spinoffs. The applications studied generated $21.6 Billion per year in sales and benefits; 352,000 (mostly skilled) jobs; $355 Million corporate income tax. Individual income taxes were not covered in the report, but if the jobs created averaged $30,000 per year, and the income tax averaged about one fourth of that, $2.64 Billion of annual income tax would have been created, from the sliver used as the study group.

An article about this report appeared in the August 1992, National Space Society's Ad Astra magazine. It summarized a presentation given at the National Space Society's 1989 International Space Development Conference, in Chicago.

1990 ENTERPRISE INSTITUTE STUDY

In 1990, G. Harry Stine headed an aerospace industry economics think tank, in Phoenix, Arizona, known as the Enterprise Institute. This is not to be confused with the more general conservative political think tank, known as the American Enterprise Institute.

The following economics projection was given in the November 1990 issue, of the National Space Society's Ad Astra Magazine. "Stine and Hans claim that industrial spinoffs from NASP (National Aerospace Plane) breakthroughs will also be big economic pluses. The spinoffs they envision include ice-prevention concepts, cryogenic materials handling techniques, machinery able to run at much hotter temperatures than now possible, ceramic automobile engines and better automobile brakes."

"Even water transportation would benefit, they maintain. NASP will bolster engineers' understanding of computational fluid dynamics, allowing the design of ships with better hull configurations and better propeller design, which would mean faster, less fuel-thirsty ships."

"Other industries Hans and Stine predict would get lifts from NASP spinoffs include chemical and allied products, non-electrical machinery, photo and optical goods, motor-freight transportation, fabricated metal products, and primary metal industries."

"Stine also cites NASP's impact on low-technology industries, such as frozen fruits, juices and vegetables industry. Among the technology concepts that might transfer: how to prevent ice, how to store heat, fuel systems, cryogenic insulation, and thermal management. One company they approached, Stine recalled, wanted to use liquid nitrogen at -179 degrees C, rather than corrosive brine, to freeze popsicles four times faster."

"After analyzing the top 10 industries that could benefit from NASP technology, the Enterprise Institute estimated that NASP spinoffs could improve the sales income in each industry by at least 1 percentage point a year after the passage of a decade. Revenue for the top ten right now (1990) is $1.77 Trillion a year, Stine says. 'Run it out, and in 1999 (from the 1990 study) they're producing $2.626 Trillion. One percent of that is $26.2 Billion'."

"For a 'sanity check', the Enterprise Institute showed the analyses to economists, people in major investment banks, investment brokers and venture capitalists, Stine says. 'We were told that this is overly conservative-they're saying an order of magnitude or more higher.' That would translate to a 10-fold increase in added economic impact, which would total about $260 Billion a year."

"That stacks against Stine's estimate of $23 Billion (1990) for NASP research, construction, and development. 'The increase in GNP (Gross National Product) by 1999 (from 1990 study) will more than pay for the entire NASP program with just one year's additional revenue."

"The results, he adds, could employ 650,000 people in 1999 (from 1990 study) and, that year alone, add $6.5 Billion to tax income. Those numbers speak for themselves."

"National economic survival depends on spinning off high technology down to the low-technology industries. High-tech industries, particularly aerospace, have always been net contributors to the international balance of trade of the United States, Stine explains."

THE HYPOTHESIS

Many industries below the top ten could also benefit from broad technology base research and development efforts, whether developed by government or developed by industry. The expansion of the American technology base could also tranfer over to desparately impoverised nations to help them establish viable economic opportunities for their populations. They would have to develop reasonable trade relations, innovate new products, and diversify their industries. Lack of investment into third world economies from outside is only restricted by dictatorships, which keep their people poor and powerless. Where technology transfer isn't possible, increased national wealth in America, also helps us to better battle poverty at home and internationally.

Based on these research studies, and the potential for millions of good paying technology derived jobs, we can conclude:**ANY STRONG NATIONAL COMMITMENT TO A BROAD TECHNOLOGY BASE RESEARCH AND DEVELOPMENT EFFORT, SUSTAINED OVER TIME, WHERE EXTENSIVE TECHNOLOGY TRANSFER IS MADE READILY AVAILABLE TO AMERICAN INDUSTRY, WILL OVER A 5 TO 10 YEAR TIME PERIOD AND BEYOND, CREATE MILLIONS OF PRIVATE INDUSTRY JOBS, EXPAND THE CREATION OF GOODS AND SERVICES, EXPAND THE NATIONAL TAX BASE, HELP RAISE THE STANDARD OF LIVING, STIMULATE THE U.S. ECONOMY, PROVIDE OPPORTUNITY TO REDUCE INDIVIDUAL TAXES, REDUCE INFLATION, AND REDUCE THE FEDERAL DEFICIT.**

The next two pages contain a copy of a letter I sent to the honorable Mr. Edward Finch, in 1992, hoping to help the Bush campaign. Ed Finch is a cousin to former President Bush. He wrote his reply on my letter, and faxed it to me(J.David Baxter).

ANALYSIS:

The key problems with using broad technology based research and development to stimulate the economy, is a high up front public or corporate investment of billions of dollars, with significant economic impact taking from five to ten years to be realized. This lag time might be reduced by making new technologies readily available to commercial industry. With the waiting period, Congress and the White House tend not to make a commitment due to a desire to bring about dramatic results for the economy before the upcoming election. Also, public opinion doesn't realize the full economic impact of space research on the national and international economy. Public opinion views space research as a drain on limited resources, rather than an investment in future economic growth in many areas of concern to mankind.

In the Enterprise Institute Study, the spinoffs are predicted. It should be pointed out that the general areas for needed research and development can be known in advance. Possible areas where spinoffs might benefit can be speculated. Also, past history can be used to help predict future trends. However, the specific solutions, and all of the possible practical applications cannot be known in advance. There is plenty of room for innovative thinking, and approaching problems and practical applications from previously unforeseen angles. Otherwise, there would be no need for research and development, because all the answers would involve existing technology.

It should also be pointed out that not all technology used in a major space commitment involves new technology. Much of the infrastructure would involve the construction of existing technology. But the accompanying research and development pays back the total investment many times over. If for some reason in the future, the spinoffs didn't pay back the investment, due to extensive infrastructure, direct benefits, such as low cost space transportation, space manufacturing, space tourism, and space mining would have to make up the difference to make the efforts economically viable. The benefits to mind and spirit are outside of economics, but also justifications for space development.

It should also be pointed out that manned space exploration research and development is often interchangable with technology needed to explore the Earth and oceans. It is of interest to note that the late Jacques Cousteau was on the National Space Society board of governors. For balance, we need advancement in all of the sciences.

With the alternate solutions for unemployment, and reduced inflation, increased quality education spending would help more people become competitive for the workforce at decent wages. Some of the better educated will be able to contribute to the technological innovation and other innovations to spur economic growth. However, this also is a long term solution, and there has to be the jobs waiting for the people who have been well educated, for increased education spending to benefit economic growth.

Cutting taxes can help spur investment for faster growth in the economy, and with this, more jobs, more consumer products, and less inflation, due to expansion of the economic base. More money can be created, with more goods to satisfy the economic growth to reduce inflation. The development of new technology also expands jobs, and consumer goods, leading to a reduction in inflation.

But with cutting taxes, the risk increases, at least in the short term, of reducing economic stabilizers, and hurting the short term public good.

Reducing the deficit will reduce inflation. However, if deficit money is invested in technology that pays back the investment seven fold, the short term borrowing could help long term deficit reduction. Expanding the tax base with good income jobs, would make deficit reduction more obtainable, and even consistently reduce the national debt over a period of years, especially if a good, say 4% increase, in GDP per year can be maintained over twenty years.

CRITERION FOR THE BEST SOLUTION:

The ~~following~~ GIVEN SPACE report reflects what may be the best solution to reducing inflation, and spuring employment. However, wise balancing of this with the alternate solutions, in the best economic mix possible, would maximize overall results.

Possible solutions; Selecting the best solution or combination of solutions; defending the solution.

These areas have been covered. Both weaknesses and strengths have been explored. The best combination of solutions would combine the maximum strength of each approach at minimum short range loss to the public, balanced with maximum long term gain. Great depth of economics research and case histories would have to be studied to determine the best possible mix.

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Commentary To Space Economics Report

Ever since the Apollo Program cutbacks our advancement in manned spaceflight beyond Earth orbit has been stalled, with government funding and involvement, due to the priorities argument. The government's higher priorities compete with NASA for funding. These higher priorities include federal entitlements, reducing the federal deficit, defense spending, and national & International poverty relief. With the exception of defense spending, almost all of the higher priorities tie into the nation's economics.

First we need to prove to Congress and the White House that a strong investment in space related research and development to support major advancements in manned spaceflight, would over five to ten years and beyond, effect the national economy in such a way that all of the major economics related federal priorities would be benefit substantially from the increased national economic wealth. The commitment would start with extensive manned exploration of the solar system, with advancements in space transportation included. Eventually, space tourism, manufacturing, and mining would become established with substantial space colonies.

Of course public opinion is oriented toward the higher priorities, especially entitlements. With public ignorance on economic matters, a temporary slump in the economy can lose elections for congressmen, and the President. A strong government sponsored public relations effort on the economic benefits of space and other wide technology based research and development efforts, could substantially increase both government and public support for these efforts, especially if the public realizes that the higher priorties in public opinion will prosper as a result of an expanding economy.

The other solution is multinational corporation involvement. But unproven technology, the waiting period, and the cost of such commitments could discourage private sector funding to achieve the major manned space goals. If American industry could be convinced with experimental, and theoretical evidence that the new technologies are very real possibilities with great economic potential, this attitude could change. Private property rights in space, and research and development risk insurance from the government, would make the investment more attractive to American industry.

I propose a publicly funded Space Program aimed at space tourism, space mining, and space manufacturing. A key to making this economically viable, will be a vast reduction in space transportation costs through the NASA Lewis Research Center's Breakthrough Physics Propulsion program.

The first step would be for interested companies to do their own experimentation, and theoretical work from their own resources, venture capital, or government grants. Priority would go to fast, cheap space transportation breakthroughs. This could include travel to Earth orbit, as well as solar system travel. Work by Zinsser in Germany and Hathaway and Hutchison in Canada have shown experimental promise in this area of research.

The second step would be to allow the general public, ten years or more in advance of retirement to invest up to a third of pension investment into space development that has shown strong potential for a good return on investment. Royalties from spinoffs, space tourism, space mining, and space manufacturing would all add long range substantial return on investment. However, this investment would be backed by government issued research and development risk insurance. An emerging technology would not receive research and development funding from the public resource until it has proven itself viable in the first step. Should a new technology fail, the government would pay back the investors via the risk insurance. Only multibillion dollar major failures would require taping the federal deficit. But with sound preparation, this problem would be very unlikely to occur. Space construction for mining, tourism, and manufacturing would also be funded out of this resource. In addition to public investment,corporate venture capital, and a guarantee of outer space property rights would also be encouraged.

Pension money is the top priority in government funding. Government issued and private sector pensions are so extensive that they are used to back the national debt.

The spinoffs from past space progress have been so extensive as to return the national investment many times over in the national economy. Patent royalties, the creation of millions of private sector jobs, based on an expanding national technological base. To shorten the time gap that this takes place in, the new technologies would be carefully tracked, and made readily available to the marketplace in the national and global markets. Add to that, the rich mineral resources of the solar system, and new space manufacturing industries, and the invested money would be paid back many times over. The tax base would also expand with good paying jobs, making lower taxes, lower inflation, deficit elimination, and national debt reduction possible.