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Critical National Need Idea Title: **Multipurpose Mindset**

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Introduction: This White Paper starts off with a conclusion from forty years' engineering experience, and brings attention to several paradigm changing projects that can be begun small. All are Win-Win situations.

Critical Need: from my experience I have learned that the current mindset for most technology industries is to focus on single purpose, specific solutions resolving mainly one single problem. Fringe benefits are always welcome, but synergistic solutions to more than one problem at a time are few. This is a mindset, derived from the narrow goals of highly focused business managers. As an engineer with some forty years' experience, I can attest that if tasked, most engineers will rise to the challenge of multiple synergistic solutions. They merely need to be encouraged, tasked by the business managers. Better yet, industry needs to change to encourage Engineers to exercise imagination and business acumen, their contribution sought, for their own ideas for innovation and product concepts. For that end the engineering profession is a largely untapped resource. Unfortunately industry today is too much in the hands of A) sales oriented people whose horizons are limited by the a) what exists, b) what the customer base requests, B) accountants whose visual scope invariably is the past, and whose natural focus is on better reporting and cost reduction, and C) lawyers whose guardian instincts and mandate more often than not stifle projects received from sources outside their company, where the source is from an individual – whose idea is not defended by a legal castle wall. Not that these are not needed, but in the internal politics of industry where the focus is always short term, one quarter at a time, short sight is rewarded more than long term vision. That MUST change.

Thankfully, a partial change has already occurred, in that the computer and software and electronics industries were created by a generation of engineers and non-engineers that rebelled against the restrictions cited above. However, this steam is running out, and new paradigms need to be found.

Transformational results: To commence the change, projects need to be initiated, mandated, at the Federal level, that have as their basic stated goals the simultaneous attacks on multiple problems, using one approach to attain more than one purpose or even having the solution to one problem derive from the solution to a different one. Once such a mindset will come to prevail in industry, the Engineer will naturally be tapped and listened to more, even if not a member of the company, since of necessity the Engineer is the technologist knowledgeable in a multiplicity of fields.

One extremely well known example of such a synergistic approach is in Energy: by increasing dependency on renewable energy sources (agro, wind, geothermal, water, etc), we will reduce dependency on oil, hence pollute less, reduce global warming, be less dependent on foreign sources, and reduce the income of countries not amicable to the US. Yet even in Energy the accent is on one technology at a time.

Were small systems available to transform paper and cardboard into methane by fermentation, using a technology of sufficiently low price and low maintenance – the methane could then be used as an energy source. If done at small waste dump sites, it would reduce dependency on land fills on one hand, and the distributed electrical production would reduce dependency on the central electrical power plants and large scale distribution systems. However, this concept is not new, and this author is merely reaffirming its importance. The work to be done is actually on the engineering side, best performed by a specific contract bid to engineering firms, with the resulting technology licensed to many systems suppliers. It is however an example of how resolving one problem can alleviate another.

Societal challenge: as an example of a synergistic Project, a concept is hereby submitted to which this author takes pride in having ideated, being the transformation of urban organic refuse into fish food, by proliferating refuse-fed insects in incubators. The insects in turn, can be used as feed for insect-loving fish and ocean bottom feeders in marine ranches. Marine ranching is an aspect of aquaculture insufficiently explored, that has the potential of generating huge businesses replacing the current ocean fishery methods of hunting/gathering. Marine ranches have the potential of rejuvenating the fishing industry more than any alternative idea I am aware of.

Note this approach resolves simultaneously two dire societal problems: what to do with the mountains of organic refuse including paper on the one hand, and the depletion of the oceans by overfishing on the other.

To doubters I will remind of cockroaches, point out that termites and carpenter ants already eat wood and related materials, that fishes exist that feed on insects, and that if insects will be found to lack some essential nutrients required by fish, that particular set of nutrients can be provided separately. Moreover, whatever feed and fish feces fall to the ocean floor, can be utilized by bottom dwellers and plankton, especially if natural currents reduce the local concentrations. Doubters from the academic community have voiced their objections, mainly by citing non-fatal hurdles such as the absence of Omega 3 sources in insects. The specific societal challenge is in breaking down the mindset of turf-defending academia, by offering BAA grants to research the opportunity. Such funding approach resolves two objectives simultaneously: the need by researchers for grants, and the solution to the problem of marine life depletion.

Note: this author is more than willing to channel funding to researchers in selected and directed aspects of these technologies, for the purpose of rapidly creating an initial field project combining all the described elements.

Discussion: The following are additional areas of need for R&D in a variety of industries, each having the potential to generate societal transformations, or help overcome a societal challenge, or both. All will receive major impetus from adoption of aspects of nanotechnology.

B. Coatings: Single purpose fire-retardant paints have been designed with many formulations but few have become popular due to technical and cost hurdles, as well as the absence of additional benefits. Hence a multi-purpose paint-like coating family is needed that simultaneously performs two or more of the following tasks:

1. delaying for a time span of more than 1/2 hour (to hours and more), the ignition of a substrate under conditions of fire or fire-heated hot gases;
2. does not itself ignite;
3. for more than 1/2 hour, keep the substrate from heating to high temperature, whether that be defined as the melting temperature if the substrate is a meltable polymer, or charring temperature if the substrate is not meltable by heat at the temperatures of common fires, or ignition temperature of same;
4. generate a barrier to Oxygen to the substrate, thus preventing ignition or even charring, for a time span as required by the application;

5. create a thermal insulation coating onto the substrate when its fire-protective properties are not invoked by presence of fire;
6. create an IR reflective coating reducing the burden on Heating-Ventilating-AirConditioning (HVAC) systems;
7. create an electrically grounding surface usable to isolate an enclosure from electrical interference; creates a Faraday chamber; provides a grounding plane for electronic devices; may provide an emergency grounding plane for power electrical systems (while insulating from surface contact); provides a radar reflective surface even if the substrate is not reflective; may provide the basis for very large imaging panels for both business and entertainment;
8. rapidly create a strong but thin membrane, flexible or rigid (depending on product), usable for creation of habitats when two such membranes are used with filler in between, as instant tents, instant overcoats for both civilian and military purposes, and more.

This writer has been single handedly developing coatings such as these for some time now, has a US Patent Pending, and would be delighted to submit proposals for R&D&E grants in these areas.

The above is definitely an area of national need, providing property and life saving services. It is a synergistic, multi-purpose product line answering the basic quest for altering the single-purpose product mindset. It is a societal changer is the same way certain critical products have become changers, e.g. safety pins, velcro, zippers, sewing machines, and the like, quite unsung, but quite influential.

Nanotechnology would be in the areas of the particulates and their improved attributes when their size is in the nano range as opposed to the micro range. For fibrous materials as necessary for membranes' skeletons, we believe could be nanotubes including in yarn and textile formats – very strong, electrically conductive, and malleable. "Smart fabrics" or "smart membranes" would be derivatives.

Note: this author has already received the attention of two paint manufacturing companies for the fire-protective aspects of the above. Therefore the path to new products creation and marketing has already been found. What is still required is the initial funding to formally prove the concept and secure the intellectual property rights.

C. Information Storage: this topic synergizes Analog with Digital technology. It requires two definitions first:

1. **Compression**: where redundant information is deleted from an information stream, replaced by a much briefer information element enabling recovery of the original stream. Example: a sea-and-airscape image where the large area of blue sky is defined not by a set of innumerable identical individual pixels, rather by one such representive pixel and addresses of where the set starts and where it ends. Second example: a stream of information containing unnecessary information, which is deleted without appreciably affecting the recovery of the essential message.

2. **Compaction**: where a given quantity of information can be stored by any known storage means, but on much less surface (area of medium), without loss of information. Compaction results in increased information storage density on a given area, or in a volume. Compression may precede Compaction.

This writer ideated an approach to perform Compaction, that was subject of several US Patents in specific application media, but did not exhaust by any means the potential from this approach. The actual information densities achievable depend on the characteristics of the storage media. Fundamentally, the approach is by combining analog with digital processes/technologies.

The above is definitely an area of national need, where the challenge is to store exponentially increasing quantities of information at lower costs and increased access speeds, with minimum loss, for long time durations measured in decades or centuries. Transformational results are expected since the method of combining analog with digital information is new and very innovative, can be applied to multitudes of applications, and can create innumerable new information products. The societal challenge exists in that its

paradigm will restructure the purely digital form of today's information technology – hence resistance is unavoidable.

Nanotechnology would be tapped in the areas of implementations of the concept, since only by nanotech can very large amounts of accessible area be created, and the physical elements representing the information be manipulated. A clarifying example of what is meant by a "physical element" from our macro world, is the ink which is the physical means for storing information on paper media. An example from the microworld is the pit (or its absence), which is the physical means (element) for storing digital information on a CD or DVD. As the medium changes, other appropriate physical means are used. In the nanoworld it could be the level of magnetism in a magnetic domain, the amount of charge in a nanocapacitor, and others. Note that by this method, it is the analog entities of levels and amounts that are manipulated, by the process this author calls Levelpass.

Note: this author requires funding to formally prove the core concept and secure the intellectual property rights. The earlier granted US Patents no longer afford sufficient protection, especially to the principle and in the more modern application fields. As opposed to this author's earlier effort (under SBIR support), carefully selected subcontracting shall be employed.

D. Solar Energy Capture: One of the unrecognized breakthroughs of 2008 occurred in the area of light energy capture and transduction, by a young researcher in Australia. The field is called Plasmon, and it began many years ago with the study of the phenomenon of the amount of light transmitted through an aperture, being much greater than the amount of light impinging upon the area of the aperture. The breakthrough of 2008 consisted of the capture of this concentrated energy by micro- and nano-moundlets of material deposited on the impingement side of the capturing membrane. The phenomenon also involves wavelength transduction, and can be manipulated by the forms and sizes of the moundlets.

This author has accumulated several inches of literature published by researchers of the aperture version of Plasmon science, and can affirm the paper from 2008 is truly a breakthrough. It demands serious and concentrated attention. A BAA on the topic would spur attention and potentially result in very large increases in solar energy capture efficiency as well as electromagnetic transduction technologies.

This author expects that Plasmon technology evolving from this breakthrough will be the analog of the civilizational transformation created by the transistor.

Note: this author is more than willing to channel funding to researchers in selected and directed aspects of this science, for the purpose of rapidly creating a number of initial products based on the breakthrough and its precursors.

E. Intellectual Property Protection : The existing Patent system is rather good at protecting the rights of inventors who have specific ideas and inventions that can be transformed into specific products. However, it is not of good service to people who may have a good idea, but have a) no funds for patenting nor follow-thru capability to transform the idea into revenue ; b) no capability in practise, to defend themselves against corporate larceny should they bring the idea to the attention of a potentially interested manufacturer.

Therefore a parallel system to the traditional Patent System needs to be ideated and put in place, that would afford protection to the impecunious inventors or innovators attempting to interest parties of much greater wealth, without finding themselves victims of larceny. This new system need not yet be international.

A case in point is the inventor of the refrigerator doorshelf, a customer that suggested the idea to a refrigerator manufacturer many decades ago, but was dismissed even after the company adopted the idea. Ultimately she was paid $1000, a paltry sum in comparison to the wealth the idea produced for the industry.

Most ideators are not recognized at all, let alone paid. Even worse, is the plethora of very good ideas and innovations that never sees the light of day, due to the hurdles already dwelt upon in this paper.

The transformational result would be the very large number of small improvements to technology and products, accumulating to very large technology and societal changes over time. The societal challenge will be in creating a working system that the companies shall be compelled to follow.

I am quite confident that inventor organizations would offer many suggestions for the ways and means to create such a parallel system.

In Summary : The five described topics address the TIP request for projects addressable by high risk, high-reward research or development or both. The underlying point of departure may in the long run be even more important. It is no coincidence that the TIP contact person I called was disconcerted that this White Paper itself did not fit the TIP box – in that each topic is synergistic, not single purpose.

This author is quite willing to submit Proposals on the first four topics (A thru D). Some of the R&D work would be done in-house, some would be subcontracted.