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First Annual Report to the Deputies Committee on Complex Priorities

December 2008

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First Annual Report to the Deputies Committee on Complex Priorities

THE ELLIOTT SCHOOL
OF INTERNATIONAL AFFAIRS

December 2008

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COMPLEX

PRIORITIES

Top: ISAF (Royal Australian Regiment) by Mass Communication Specialist 1st Class John Collins, U.S. Navy
Middle: From Sartorius Stedim Biotech <http://www.sartorius-stedim.com/>
Bottom: Picture of Chinatown, New York City by Matthew Giles

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DEPUTIES COMMITTEE ON COMPLEX PRIORITIES
WASHINGTON

MEMORANDUM FOR THE DEPUTIES COMMITTEE

FROM: Uriah D. Ferruccio, Staff Director

SUBJECT: First Annual Report to the Deputies Committee on Complex Priorities

We are pleased to submit the attached draft report on Complex Priorities for your review prior to its consideration by the President. Our work over the past six months has uncovered an unsettling fragility in the way that the United States manages social, economic, political, and technological change. This fragility, if left unattended, could threaten key domestic and international interests.

We systematically assessed a variety of threats and opportunities, which we call **Future Contingencies of Interest (FCIs)**. Our work revealed a pressing need to rethink the way that challenges are understood and ultimately met.

- The old way of identifying problems is ill-suited to respond to future challenges.
- The threats and opportunities that concern us the most are not self-contained or isolated.
- Addressing complex problems independently is rarely successful and carries a significant risk of unintended consequences.
- Relationships between future threats and challenges exist, but they are often not identified until it is too late to respond effectively.
- Finding these relationships represents our best method of solving complex problems.

Through rigorous research and intuitive inquiry, we have found a way to discover the relationships that occur between multiple Future Contingencies of Interest. For the present report, we narrowed down our field to three **Complex Priorities** that we believe require the immediate attention of the President and the U.S. Congress:

- Managing technological innovation;
- Fragility of the state-based international system; and
- Socio-economic fragility.

With further study, we believe that the United States will begin to formulate better ways of addressing these challenges. We welcome your comments and questions. We will incorporate all feedback into the final report prior to its submission to the President. Thank you in advance for your feedback.

Uriah D. Ferruccio

December 15, 2008

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The Fall 2008 Forward Engagement Class wishes to thank the following people for their support and guidance: Mr. Justin Zorn, Mr. Evan M.H. Faber, Dr. Sheila R. Ronis, Admiral James Loy, Dr. John Bordeaux, Mr. John F. Meagher, and Professor Leon S. Fuerth.

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I. EXECUTIVE SUMMARY

The ability of the state to protect the national interest requires greater awareness of the future implications of the challenges and opportunities we face today. Governance must become more alert, responsive, and successful in dealing with multiple, interrelated, complex problems.

Policymakers need to be conscious of their responsibility for managing multiple Complex Priorities. This does not supersede the daily activities of governing. However, it does require **simultaneous consideration of multiple interacting issues** across time that may have unexpected effects and involve factors beyond those normally considered relevant to the issue.

This staff has identified **three Complex Priorities** that should receive the immediate attention of the Executive and Legislative Branches.

- **Managing technological innovation.** Technological and scientific advances have dramatically altered human development. The progressively faster rate of innovation is a sign of major change in the near future. Scientists and inventors are working to manipulate matter at the microscopic level with potential consumer, medical, and military applications. Keeping policy abreast of these developments, harnessing the creativity of scientists, and ensuring an appropriate level of regulation present crucial challenges.

- **Fragility of the state-based international system.** Challenges to the state's monopoly on power are increasing in number and strength. Technological innovation and an increased flow of capital, goods, people, and information across borders has empowered individuals, communities, and businesses. At the same time, states are proving unable or unwilling to cope with critical transnational problems such as global climate change, resource scarcity, and pandemic disease. These challenges suggest an imminent shift in thinking about the role of the state.

- **Socio-economic fragility.** Globalization influences billions of lives each day. Global financial transactions and trade, the Internet, the news media, and the images of western popular culture have altered our perceptions of the state, the economy, and social organization. While globalization has produced many benefits for humanity, we are also acutely aware of the sensitivity of social and economic systems to disruptions. Events over the next 5-10 years could have even more profound effects.

In light of these considerations, this staff makes the following **major recommendations**.

- **Improved analysis of complexity.** We found a serious deficiency in the way that complex problems are understood. Most analysis is too narrow or regards problems as static. Improved analysis demands strong interdisciplinary and interagency evaluation and engagement. Effective policymaking requires a firm grasp of opportunities for shaping the outcome of a trend or event.

- **Improved interagency coordination.** The traditional organizational structure is ill-suited to managing Complex Priorities. Interagency policymaking is inefficient, inflexible, and

overly hierarchical. It poorly integrates information and resources, and discourages or undermines innovation.

- **Task forces to manage Complex Priorities.** Three task forces should be established by the President to guide the management of the Complex Priorities identified by this report. They would study positive and negative scenarios and provide recommendations to the Principals Committee. The task forces would be drawn from all relevant U.S. government agencies and use our recommended method for analyzing complexity.

There is strong bipartisan support for improving the U.S. Government's ability to handle major concurrent challenges affecting the state of our nation. We must move swiftly and decisively to enact these changes.

II. KEY TERMS

Complexity: As it is applied to public policy, complexity refers to the state of a system such that there is not a static, linear relationship between cause and effect. Complexity accounts for the seemingly spontaneous generation of outputs that are radically disproportionate to their inputs. In reality, complexity renders command and control thinking impotent.

Future Contingency of Interest (FCI): An event or trend capable of abruptly and significantly upending the anticipated course of events. It is helpful to analyze FCIs with respect to their potential social technological economical environment and political impacts (STEEP).

Complex Priority: An important policy dynamic that arises from the interaction of a number of FCIs interacting in a systemic, simultaneous manner. As complex, interacting systems, it is impossible to manage Complex Priorities by engaging their FCIs individually. Complex Priorities are characterized by non-linear changes and often give off faint signals that may alert policymakers to the onset of significant change.

Trajectory: The motion or directionality of events resulting from FCI interaction. Trajectory analysis is one method of organizing the various FCI tangents into manageable pathways to aid policymakers in identifying critical engagement opportunities. When analyzing Trajectories, it is useful to utilize scenarios to illustrate possible outcomes that could occur depending upon various FCI interactions and policymaker responses to them.

Trajectory Analysis: Form of analysis – one based on the interaction of Trajectories from various Complex Priorities – that explores potential pathways into the future and identifies key opportunities for implementing well-anticipated policy.

Engagement Opportunities: For the purposes of this paper, Engagement Opportunities are opportunities may have critical effects on a Trajectory. Taking successful advantage of an Engagement Opportunity can cause an intervention to have cascading effects with system-wide reverberations. These effects could serve to enable or preclude an event, or encourage or discourage a trend.

STEEP Model: A method of analyzing FCIs by breaking down their possible effects into the following categories: Social, Technological, Environmental, Economic, and Political (STEEP).

Scenario: An account or synopsis of a projected course of action, events or situations that requires a temporary suspension of disbelief. Scenario development assists in policy planning, organizational development and as a tool for to test strategies against uncertain future developments.

III. Engaging Complexity for U.S. Interests

Events over the last decade and a half have demonstrated the American government's increasing inability to manage today's complex challenges. Critically, our government has exhibited an increasingly clear pattern of failure to adequately anticipate oncoming crises. How many crises have we known about too late? Our failure to connect the dots of Al Qaeda's bombing of the U.S. Embassy in Kenya and its attack on the U.S.S. Cole led to a half-hearted and uncoordinated response that allowed Al Qaeda to successfully carry out the attacks on September 11, 2001. One major consequence of this catastrophe has been the realization that our understanding of the world is based on a false assumption of stability; it is clear that we can no longer afford to conceptualize events as occurring in isolation.

"One major consequence of these events is the realization that our understanding of the world is based on a false assumption of stability."

This study seeks to address that deficiency by introducing mechanisms for integrating the concept of fragility into the responsive institutional apparatus of governance. Fragility refers to the susceptibility of established institutions to change. By eliminating the assumption of stability from our paradigm, we can incorporate new directions and adaptability into our response framework and policy recommendations. This is especially true as the rate at which relatively minor, seemingly unrelated trends and events develop into major global incidents that outpace our ability to govern. We can no longer address complex problems through reactive analysis, or resolve them with narrow solutions. Nor can we afford to wait until negative developments reach fruition to act. The adaptive capacity of U.S. governance, therefore, hinges on two requirements: 1) Proactive Assessment - confronting contingencies *well before* they happen, and 2) Complexity Analysis - factoring various future contingencies *simultaneously* as a larger system of interactions.

Complexity as it is applied to public policy refers to the state of a system such that there is no static, linear relationship between cause and effect. Complexity accounts for the seemingly spontaneous generation of outputs that are radically disproportionate to their inputs. In reality complexity renders command and control thinking impotent.

These two elements together are the cornerstones of the *Project on Forward Engagement*.[1] Pioneered by Leon Fuerth, the objective of Forward Engagement is:

> **"[T]o encourage a more profound and continuous interaction between long-range forecasting and long-range policy-making. Encouraging this development is key to**

[1] For more information on past work of the Forward Engagement Project, see Leon Fuerth's website, www.forwardengagement.org.

better safeguarding U.S. society from unanticipated, strategic surprise and, in particular, assuring the continued ability of democratic governance to successfully deal with an increasing rate of change in every area of human activity."

The goal of Forward Engagement is to obtain actionable knowledge of critical future contingencies before the culmination of a world- changing occurrence. Ultimately, developing this method of systematically evaluating critical contingencies in the medium to long term can potentially improve our ability to steer the future course of events in favor of U.S. national interests. Thus, it is clearly beneficial for the United States to engage in long term forecasting, to both avoid future catastrophes and to take advantage of potential opportunities before they reach the point of no return.

Pursuant to our mandate, we, the staff of the Deputies Committee on Complex Priorities (DCOM), have developed this report to provide DCOM with both a theoretical and practical framework for assessing the international environment and how specific trends might interact.[2] By analyzing important contingencies as systems rather than evaluating them in a disaggregate manner, the staff has identified three (3) **Complex Priorities** crucial to U.S. policymaking. They are as follows: the Management of Accelerating Technological Innovation, the Revealed Fragility of the State-Based International System, and Socio-Economic Fragility.

Complex Priorities designate policy areas particularly prone to dramatic change. They consist of a number of FCIs interacting in a systematic, simultaneous manner.

Although by no means representative of the totality of challenges the United States will face in the future, it is the staff's opinion that DCOM should presently focus its attention on these three priorities, for they portend to dramatically upend U.S. interests if not managed appropriately. Furthermore, within each area, the staff has identified a number of **Trajectories**–possible pathways resulting from the interaction of contingencies within a Complex Priority. This method of analysis enables the United States to provide both a theoretical and practical framework for making policy choices.

Trajectories are the precursor to scenarios, indicating the possibility of an outcome depending upon the FCI interaction and policymaker responses to them.

To understand the value of this approach, it is helpful to consider certain past events from this new perspective. U.S. responses to the fall of the Soviet Union, the outbreak of Sudden Acute Respiratory Syndrome (SARS), and the East Asian Financial Crisis outbreak were shown to be incapable of managing U.S. interests. We only understood the reasons for failure in hindsight—namely, that the policies implemented meant to address isolated events when in fact each event was part of a larger system of complex interactions that rendered policies ineffective. In failing to recognize the interconnectivity of the system, we missed valuable signals that may have forewarned of a greater crisis and we treated them instead as discrete events. For example, a narrow understanding of the Soviet Union before the close of the Cold War did not allow the United States to foresee or prepare for its collapse. This left policymakers with outdated options that could not adapt to the new balance of power.

[2] For more information on the roles and responsibilities of the DCOM, please refer to the December 2007 Report of the Presidential Transition Office

Another example is the Sudden Acute Respiratory Syndrome (SARS) outbreak. The combination of decentralized, national public health systems and opaque governance in the People's Republic of China allowed for the unexpected rise of what may be the next pandemic.

A third and final example is the 1997 East Asian Financial Crisis. The lack of regulation by international institutions such as the International Monetary Fund (IMF) and the World Bank allowed for the flow of hot capital into domestic economies, resulting in a cascading economic failure, prescient of the 2008 U.S. financial crisis. The inability to recognize the nature of the interconnectivity of various economies caused regulators to impose policies that exacerbated, rather than assuaged, the situation.

In each of these events, we can see that the system was not as stable as we believed, and that an analysis of the complex interactions might have led to a more effective set of policies that seek to intercept events before they culminate in a crisis. Therefore, this report promotes a new approach to anticipatory policy-making. It addresses weaknesses in the traditional mode of thinking by challenging false assumptions and replacing them with an awareness of the fragility and instability of the system. Awareness of fragility necessitates a need to remain open to possibility and avoid recycling out-dated policy tools that are rough approximations of the political machinery required to navigate the challenges of an evolving world.

"By failing to recognize the interconnectivity of the system, signals that may have forewarned of a greater crisis were treated as discrete events and thus their true significance went unnoticed."

Through expanding the notion of Complex Priorities and introducing the concept of Trajectories, we are able to articulate a new and better way of conceptualizing complexity that applies to all levels of situational analysis. In addition, we have combined intuition, observation and prior evaluation to identify similar situations and events that might otherwise go unnoticed under the current system; this has also led to a more comprehensive method for anticipating and pre-empting such future crises.

The Deputies Committee on Complex Priorities (DCOM) *consists of Deputy-level representatives of each of the major existing executive councils and bodies and serves as a springboard for cross-disciplinary and cross-functionary analysis, assessing Complex Priorities and making recommendations for actionable policies to the PCOM.*

However, we are not advocating a replacement of the current system. The immediate issues addressed by the President's Committee on Complex Priorities (PCOM) and other branches of government are vital to the proper functioning of this nation. We feel that the introduction of complexity analysis will greatly increase the ability of the United States to respond to change, crises, and opportunities in a timely and effective manner. We hold that individuals may easily be exposed and trained in this method. It will be simple to implement by those working at all levels of government. As this problem-solving approach will also apply consistently across all government agencies, it will also serve as a unifying and cohesive force for the inter-agency system.

The President's Committee on Complex Priorities (PCOM) *is comprised of the President of the United States, Executive Department Principles, Assistants to the President and other key members of the Cabinet who focus on executing policy by task forces that utilize resources, personnel and action from different parts of the government. (Source: December 2007 Report of the Presidential Transition Office)*

Moreover, this method gives policymakers the tools to more effectively adapt to complexity and allows them the possibility of

steering the United States towards desirable, rather than undesirable, future Trajectories. To this end, we have included several recommendations for consideration in guiding the further development of complexity analysis to intersect potential crises and seize upon new opportunities.

IV. A New Conceptualization of Complexity

This section of our report clarifies the conceptual tools we used to identify the small-scale and large-scale systems at each level (horizontal) and between levels (vertical) of analysis. Our conclusions regarding engaging the future depend on recognizing relationships between these systems that may not seem apparent at first.

We must emphasize that the future is unwritten, but information can be harnessed from the past and present to project future possibilities. The Forward Engagement process takes past lessons and present developments of "faint signals" to give policymakers the ability to anticipate what might happen next. In this respect, the Forward Engagement process not only attempts to harness information about a single future but also multiple possible futures. Implicit in this statement is an acknowledgement of the disruptive potential of an unexpected event or outcome. As discussed earlier, a **Future Contingency of Interest (FCI)** represents just such an event or trend capable of abruptly and significantly altering the anticipated course of events. One historical example would be the assassination of Archduke Franz Ferdinand that sparked World War I.

The field of FCIs is nearly infinite, resulting in a limitless number of possible interactions as well. It is impossible to consider all FCIs in preparing for the future. We will focus on a small section in this field of FCIs. FCIs are represented by the grey dots in Figure 1 (on the following page).

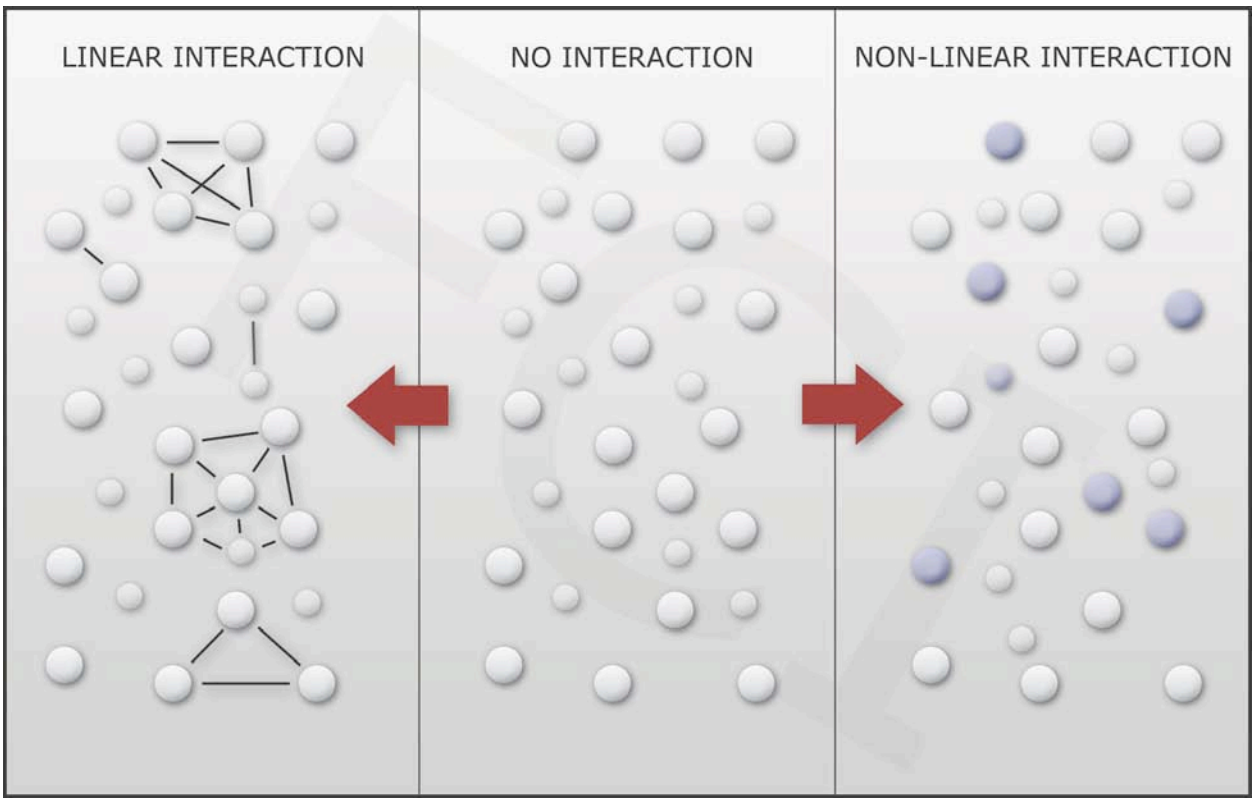
FCI: Event or trend capable of abruptly and significantly upending the anticipated course of events. FCIs can be analyzed with respect to their potential social, technological, economical, environmental, and political impacts (STEEP)

Although both individual and groups of FCIs are important, the Forward Engagement process is mostly interested in how FCIs interact with each other to have a larger, more consequential impact. Some FCIs interact readily with each other to form **connections or links** (see Figure 1). Links and connections are 1st, 2nd…nth order impacts that arise out of FCI interactions. That is, some FCIs are associated to the extent that their respective inputs combine to create larger joint consequences. These links serve as the starting point for our discussion.

As outlined in the previous section, **Complex Priorities** designate policy areas particularly prone to dramatic change in light of recognized Future Contingencies of Interest. Identifying component FCIs might seem difficult at first. While Complex Priorities include the link and connections of FCIs (as suggested in Figure 1), the relationship among FCIs does not truly depend upon close spatial proximity. FCIs may appear unconnected, yet they are in reality interrelated in important ways. Figure 1 demonstrates the challenge of uncovering the underlying interactions among FCIs that distinguishes one Complex Priority from another. Color-coding enables the United States to see these relationships by transcending the bounds of spatial proximity.

By considering the same cross-section of the field of FCIs, we see how Complex Priorities can "share" FCIs. Blue dots represent the constituent FCIs in the Complex Priority below (see Figure 1). Grey dots denote FCIs, whose interactions are not particularly meaningful to the outcomes of this Complex Priority. In other words, the fundamental character of each Complex Priority consists of non-linear interactions between component FCIs that may or may not be shared by other Complex Priorities.

Figure 1: Different Ways to Represent Complexity



Complex Priorities feature consequences not previously observed in singular FCIs taken individually. Since the **emergent impacts** of system of interacting FCIs are irreducible to the Complex Priority's constituent parts, it is important that policymakers be able to analyze future contingencies at the macroscopic level to be able to understand the true impact of any one event, or lack thereof. Systems level analysis of future contingencies is thus integral to more effective policymaking in the present.

Furthermore, these emergent impacts feed back into the system and affect the very interactions themselves, resulting in an ever evolving and dynamic system. It is thus impossible to know precisely how such a system will behave, as the level of complexity is beyond conventional forecasting. These systems possess the potential for cascading, tipping point, and other system changing effects that are not readily predictable. However, just like the stock market, trends and patterns emerge which can be studied intensively by analysts and projected into the future, despite their being no distinguishable controlling mechanism.

As such, we identify a number of **Trajectories** within a given Complex Priority. Each Trajectory represents a general path describing the way in which future events may play out, due to differing levels of active FCI influence possible within a Complex Priority. Differentiating Complex Priorities

into Trajectories allows the United States to organize the myriad of tangents that could spawn from the interactions of FCIs, simplifying Complex Priorities into manageable subsystems that policymakers can engage.

In summary, this staff is concerned with how to influence the future. Bearing in mind that we must deal with the system as a whole, this report seeks to convey which interactions are dominant and have a proportionately greater influence.

SUBSECTION 1: TRAJECTORIES VERSUS SCENARIOS

We can think of a Trajectory as representing the direction that a complex system might in the future. The difference between Trajectories and scenarios is one of motion, or lack thereof. A scenario is static; it represents an imagined end state. Conversely, a Trajectory has motion and directionality. One can foresee any number of scenarios along the continuum of a Trajectory (see Figure 2 on the following page).

Trajectories organize the myriad possible interactions of FCIs into manageable pathways and aid policymakers in identifying engagement opportunities (see Figure 3). Occupying the space between Complex Priorities and FCIs, Trajectories comprise a useful level of analysis because they capture complex interactions yet are sufficiently well defined to imply discrete policy responses. The future is not a static point, so the idea of a pathway effectively captures the fluidity and adaptiveness of reality and gives policymakers a sense of direction instead of a sense of endpoints without any indication of proximity to them.

Additionally, scenarios are generally conceptualized through 'back-casting,' or developing a scenario and then positing the conditions necessary for the scenario to develop. Trajectories are, in a sense, 'forward casting,' or looking at patterns of events and projecting them to the future, which may be a useful tool in generating multiple scenarios for in-depth analysis.

The primary value of Trajectory Analysis is that it gives policymakers a better understanding of "when" and "where" to implement forward-looking policy. By anticipating the consequences of their policy choices, the policymakers have more options to promote positive outcomes or avoid unfavorable ones.

Trajectory Analysis, therefore, complements the other analytical tools introduced in this report by reinforcing the need for policymakers to (1) identify and track faint signals; (2) observe the development of FCIs as they relate to their Complex Priority; (3) explore possible future pathways to discover critical opportunities for engagement; and (4) anticipate the direction and the consequences of FCI interactions, and of implementing policies.

Figure 2: Trajectory Analysis

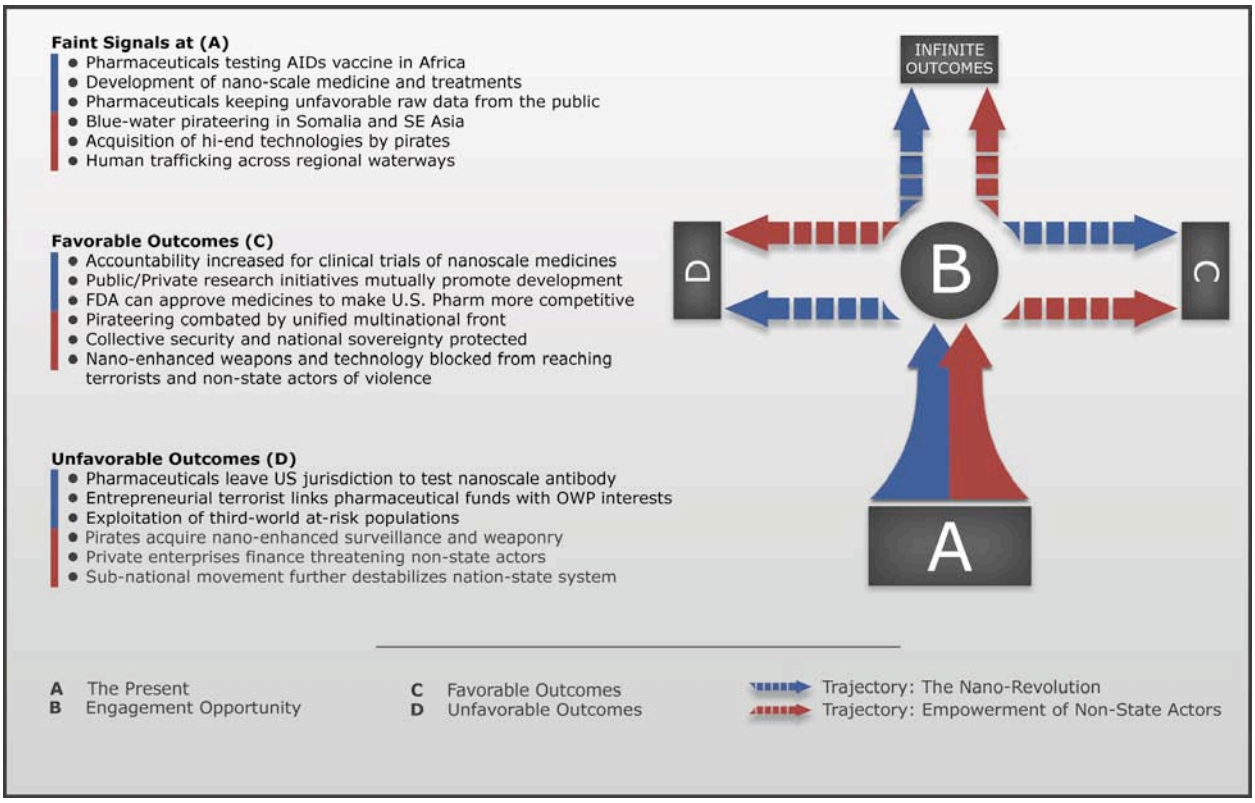
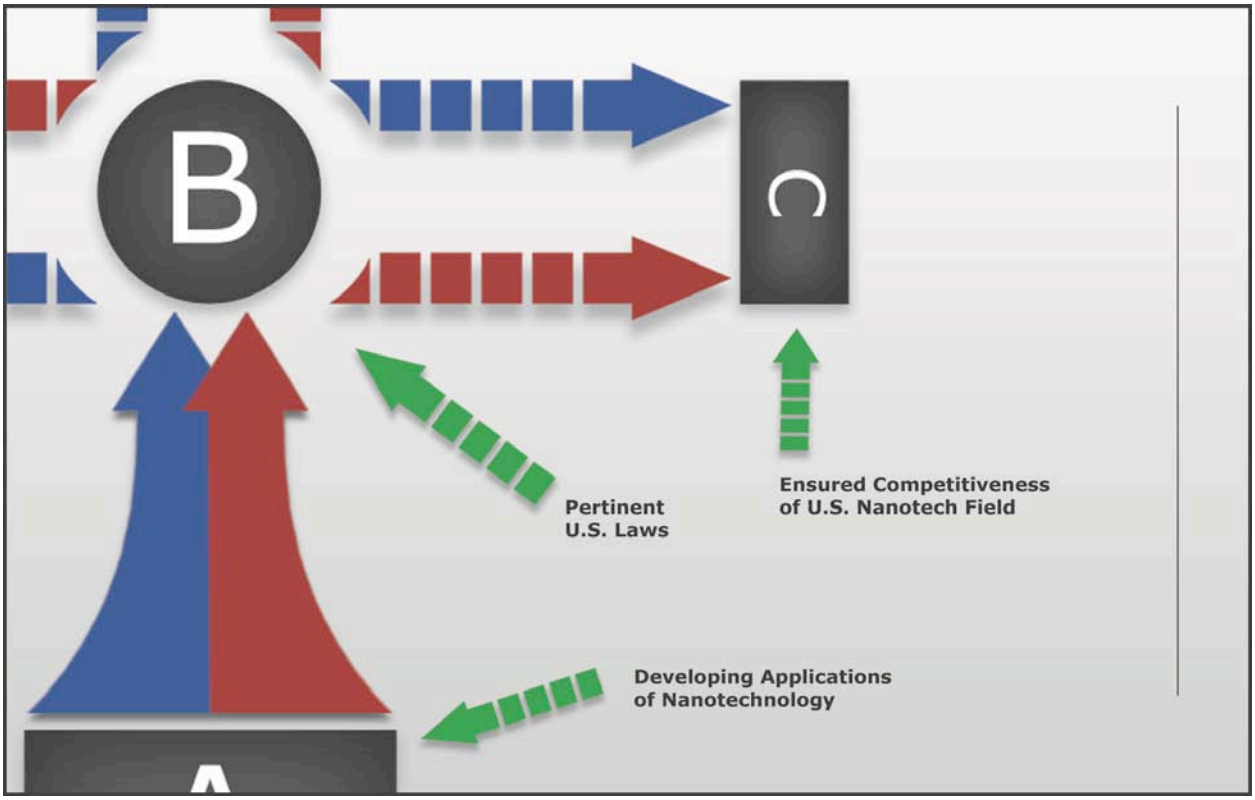


Figure 3: Engagement Opportunities



V. Complex Priorities: Managing Technological Innovation, Fragility of the State-Based International System, and Socio-Economic Fragility

Having thus introduced the key concepts of our new, analytical approach to complexity, the following pages will present in detail the three (3) Complex Priorities we recommend to be the focus of the DCOM. The purpose is twofold: to further elucidate the concept of Complex Priorities and to demonstrate that the three Complex Priorities in question are indeed priorities because they have the potential to dramatically upend U.S. interests if we do not manage them properly.

We have described the dynamics of each Complex Priority in detail, and have also identified and analyzed three Trajectories of particular interest within each Complex Priority. We will analyze the import and interaction of critical contingencies at both the Complex Priority and Trajectory levels.

Recommended Complex Priorities:

1. **Management of Accelerating Technological Innovation**
2. **Revealed Fragility of the State-Based International System**
3. **Socio-Economic Fragility**

Because of the complexity and detail of the analysis warranted, each Complex Priority will be treated in a separate section. The sections will be arranged as follows. First, after a restatement of the Complex Priority itself, we will provide a brief overview of its delineating characteristics.

Following the overview, we will present in detail three (3) Trajectories contained within the relevant Complex Priority. Understanding of the Trajectories is a necessary foundation for being able to effectively implement this method of analysis into effective policy choices. Discussion of the implications of each Trajectory will conclude with a summary of the main points relevant to policymakers. After all three of the Trajectories have been discussed, a small, sample of the contingencies that are at play for each Trajectory and the Complex Priority as a whole will be presented as a bulleted list of FCIs.

By repeating this process for each Complex Priority, we aim to provide members of the DCOM with an understanding of the multiplicity of factors that must be taken into account when considering the future, and especially the scope of the Complex Priorities we have been tasked with assessing. This process will most importantly provide practical application of the theoretical approaches earlier presented.

Following this discussion of each Complex Priority in isolation, we will discuss interactions between different Complex Priorities, considering these interactions at the Trajectory level. The ability to

assess these interactions is integral to the ability to use the information provided by a Trajectory to identify not only crucial engagement opportunities and related policy choices, but also to select when and how a given policy should be implemented. More generally, discussion of Trajectories will provide another concrete example of the intersection of theory and practice- illustrating the many positive benefits of this new form of analysis for making informed, future-conscious policy decisions.

Finally, we will conclude this report with a set of recommendations for integrating complexity and this new analytical technique into policy making mechanism in order to realize its full benefits.

COMPLEX PRIORTY 1:
MANAGEMENT OF ACCELERATING TECHNOLOGICAL INNOVATION
Advent of the Nano-Revolution and the Management of Accelerating Scientific Advancement

Few fields have seen as much progress as the manipulation of organic and inorganic matter at ever smaller scales. In 1950, scientists had not yet discovered the structure of DNA, or how it transmitted biological information from one generation to the next. The most advanced computers consisted of large rooms filled with vacuum tubes. Today, biologists are able to extract and insert genetic sequences from microscopic bacteria at will, while the billions of transistors built into a single integrated circuit give the modern desktop computer more computing power than was available to any roomful of vacuum tubes. As science continues to advance both within and between disciplines, our ability to manipulate matter at small scales will increase and accelerate, with potentially significant effects on every facet of life in America and the world.

Today, faint signals are emerging, especially in the fields of engineering and biology, and in many cases blurring the line between the two fields and other scientific disciplines. These faint signals point toward a possible nanoscale revolution as significant to our world as the agricultural or industrial revolutions of centuries past. We are already beginning to detect faint signals of a possible nanoscale revolution. Taken separately, these developments may not appear momentous. However, as faint signals become more frequent and more numerous, they will rapidly coalesce into FCIs that policymakers must account for.

The last half of the twentieth century and the beginning of the twenty-first have seen unprecedented scientific advancement. The challenge for government will be keeping policy abreast of developments, harnessing the creativity of our scientists in the interests of the United States and the world while avoiding the pitfalls of over- or under-regulation.

The manipulation of matter at the molecular level may, for instance, make possible the mass production of a novel allotrope of carbon known as the carbon nanotube. The structure of carbon nanotubes is essentially that of a sheet of graphite folded so as to become a hollow tube, though slight variations exist. Carbon nanotubes exhibit extraordinary material properties. Their stiffness is some five times greater than that of steel, their tensile strength an order of magnitude greater. Indeed, in both respects, they are unsurpassed by any other material known. They also exhibit unusual electrical properties – in one configuration, a carbon nanotube may be a more effective conductor than copper wire, while in another it may be a semiconductor.

These extraordinary properties have led to a host of proposed applications for carbon nanotubes. The engineering applications of carbon nanotube technology in both the civil and military spheres would be limited only by human inventiveness. For example, submarines capable of withstanding extreme depths could be one potential application; another might be the ability to build much larger structures for human habitation and use in environments than has been impossible in the past, or the use of nanoparticulates in biological and chemical weapons development.

Carbon nanotubes are not the only breakthrough that a nanoscale revolution would enable. Highly efficient nanowire could potentially revolutionize power transmission, while nanowire transistors and other electronic components could cause similar breakthroughs in computing and data storage.

This is far from a comprehensive list of the technological advances that may happen in the coming decades. As in prior revolutions of this kind, scientific discoveries tend to build upon and reinforce one another, keeping government and policy abreast of scientific developments will become more difficult. However, it is the view of the Deputies Committee that our political leadership must be able to make policy decisions on potentially world-changing technological developments with maximum information in hand, and with a considered view of the impacts – both positive and negative – that such technologies will have upon society. Doing so will become increasingly critical to maintaining U.S. economic and military preeminence, as well as ensuring that the world our descendants inherit will be one that we would wish to bequeath.

Trajectories of Complex Priority 1:

Trajectory 1.1: Successful Management of Nanoscale Revolution by Government Systems
Trajectory 1.2: Mass Socio-Cultural Reevaluation Due to Scientific Advancement
Trajectory 1.3: Failed Management of Nanoscale Revolution by Government Systems

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TRAJECTORY 1.1: SUCCESSFUL MANAGEMENT OF NANOSCALE REVOLUTION BY GOVERNMENT SYSTEMS

By working in tandem with researchers and civil society groups, government reaps the benefits of the nanoscale revolution while avoiding ethical controversies and environmental disaster

This Trajectory foresees a future in which government and private industry have aligned their development priorities for nanotechnology and found common ground on oversight and regulatory mechanisms to ensure the promotion of technological advances that benefit both the private and public sectors.

As is the case with many advanced technologies, early development is likely to focus on military applications, with civil applications following as production is streamlined and costs lowered. For example, nanoscale peptides may be developed for use on the battlefield to quickly staunch bleeding and accelerate the rate of tissue recovery, but come in time to see wide use in civilian medical facilities. Such a development would lead to significant reductions in fatalities and a resulting increase in overall life expectancy in the United States. Eventually, further research conducted by the pharmaceutical industry and others would allow the mass production and widespread marketing of these medicines, stimulating the U.S. economy.

Another example might be public funding dedicated to research on carbon nanotubes (CNT), which if successful could lead to mass production of CNT-based construction materials. The United States would become a leading exporter of CNT-based materials, used for commercial and residential construction as well as new vehicles for commercial suborbital spaceflight. This would sustain and promote U.S. competitiveness in a wide variety of fields, including the construction and defense industries.

The nanoscale manipulation of DNA strands could also further integrate the fields of engineering and biology to create a field of synthetic biology, which might develop synthetic organisms for a variety of purposes – air and water filtration are possibilities. Meanwhile, government regulation

would keep scientific research grounded in the concerns of the wider society, avoiding potentially disruptive controversies over ethical and environmental concerns.

Managed correctly, nanoscale scientific advances in medicine, materials, and biology could increase the quality of life globally, lengthening lifespans, enabling public works, and improving the environment.

TRAJECTORY SUMMARY POINTS

- Nanotechnology developments usually begin with military developments and move to the civil sector. Successful management begins here.
- Properly guided technology would trickle into the civil sector and improve the quality of life for Americans and our allies.
- Properly guided technology developments could also have positive repercussions in the economic and energy markets, increasing U.S. competitive advancements worldwide.

TRAJECTORY 1.2: SOCIO-CULTURAL REEVALUATION DUE TO SCIENTIFIC ADVANCEMENT

Government and the scientific community fail to assuage public fears over revolutionary technological developments, leading to continuing controversy over the costs and benefits of the nanoscale revolution

Along this Trajectory, the U.S. Government takes initiative to regulate development of nanotechnology, but public opinion at home and abroad condemns the most controversial applications of the technology as unethical and dangerous to traditional human culture. The backlash against applications of nanotechnology reveals the fragility of the balance between scientific advancement and innate human caution. This backlash forces the government to reevaluate norms and standards in a range of areas such as health and welfare, income inequality, and the possibility of meritocratic competition between those who accept synthetic enhancement and those who do not.

For example, nanotechnology may exacerbate the already-difficult questions surrounding the rights of terminally ill or vegetative patients. If nanotechnology were able to improve the condition of such patients, but could not completely restore them to a life without pain or suffering, the debate over a terminal patient's right to die or a vegetative patient's family to end life support could become yet more contentious as the gray area between life and death grows wider.

Another example might be increased inequality owing to the cost of nanotech-based health procedures. Since these treatments would be available only to those able to afford it, nanotechnology would then be viewed as a driver of social inequality, lengthening life expectancy only for the upper echelons of society while leaving lower-income patients behind. As lower-income patients die earlier and in poorer health, their incomes decrease, perpetuating economic disparity.

TRAJECTORY SUMMARY POINTS

- The socio-cultural backlash against technology would result from questions of the ethical application of science in some circumstances.
- In some cases, technology could widen the gap between socially advantaged and disadvantaged groups, raising the question of class disparity.
- As patients are able to live longer lives, questions about the enhancing quality of life versus prolonging death would again rise to the forefront.

TRAJECTORY 1.3: FAILED MANAGEMENT OF NANOSCALE REVOLUTION BY GOVERNMENT

Accidents involving nanoscience-based technologies, or the fear thereof, leads to a paroxysm of regulation that cripples the U.S. research and development base – ultimately costing the United States its global economic and technological preeminence

This Trajectory predicts a nanotechnology revolution which moves too rapidly for assimilation into political and economic models, leading to a regulatory backlash in which the further development of nanoscale technologies is restricted due to ethical or environmental worries.

One example might be a near-accident or simply widespread dissemination of the belief that the U.S. water supply could be contaminated by uncontrollably self-reproducing, synthetically engineered water purification organisms. U.S. legislators would rush to restrict research and development in synthetic biology to assure their constituents in the name of public safety; this could have negative consequences for other nanoscience-based fields as well. Indiscriminate regulation would cause U.S. nanotech industry to contract, allowing other countries to rapidly expand their own nanotech industries and drawing scientific talent away from U.S. companies.

Under such circumstances, the United States would come to lag behind other, more research-friendly countries in scientific and industrial research and development, damaging the U.S. economy and reducing or eliminating U.S. global dominance in the military, scientific, and industrial sectors.

TRAJECTORY SUMMARY POINTS

- The overregulation of technology could create a technology gap between the United States and its competitors, generating an unfavorable market for U.S. technology and technology-based products.
- New technology can and sometimes does fail, resulting in new problems without readily accessed solutions.

RELATED FUTURE CONTINGENCIES OF INTEREST

- Mass production of nanoparticulate biological and chemical weapons
- Land, sea, and air vehicles constructed from carbon nanotube-composite material, entailing a significant leap forward in capabilities
- Development of nanoscale intelligence, surveillance, and reconnaissance technologies
- Advanced forms of treatment for cancers and other diseases

- Ability to repair and regenerate lost or damaged tissue
- Very large building structures and deeper, larger underground structures
- Synthetic organisms capable of processing waste and creating biofuels

COMPLEX PRIORTY 2:
THE REVEALED FRAGILITY OF THE STATE-BASED INTERNATIONAL SYSTEM

"[Power's] content and the manner of its use are determined by the political and cultural environment. Power may compromise anything that establishes and maintains the control of man over man."

- Hans J. Morgenthau, Politics Among Nations: The Struggle for Power and Peace (New York, NY: Alfred A. Knopf, Inc., 1973)

Sub-state challenges to the control of traditional, state-based governance are increasing

Over the last two decades, challenges to the traditional state monopoly of power have increased. Technological innovations and the accelerated flow of goods, people, capital, and ideas have empowered individuals, corporations, transnational networks, and other non-state actors. Non-state actors have become empowered to such an extent that they now pose existential threats to traditional, state-based governance. Increasingly powerful non-state actors pose major threats to the governments of weak and failing states in particular. Environmental factors, including water scarcity, desertification, and the growing effects of global climate change add to states' burdens and complicate their ability to effectively project power and exercise control over domestic and international affairs.

Governments must respond more effectively to these challenges

Looking ahead to the next decade, it is likely that these challenges to governance will require states to seek new means of managing challenges, projecting power, and protecting traditional state roles. This staff has identified the dynamic of sub-state challenges to the control of traditional, state-based governance as a Complex Priority and has sought to investigate its principal drivers and possible Trajectories.

Recent events illustrate the new challenges to state control

Recent events illustrate the growing challenges to the control traditionally enjoyed by states. The September 11, 2001 terrorist attacks, the London train bombing, and the recent

"…[G]lobalization has posed serious challenges to governance in East Asian countries. Crises in development have greatly eroded the legitimacy of the existing political economic model, while East Asian governments' failure to overcome the crisis has brought about political instability. Succeeding governments have come to power with promises to carry out necessary reforms, but are unable to keep promises in face of economic difficulties and opposition. The capacity of governments to deal with domestic problems has been significantly reduced as firms, financial institutions, and social groups have gained new freedom, including the power to challenge government regulations."

Chung Jin-Young, "Global-ization and East Asia: Challenges to Governance and Its Developmental Future," East Asia Review, Vol. 14, No. 4, Winter 2002, pp. 20-21.

terrorist attack in Mumbai all demonstrate the increasing potency of transnational terrorism. The Taliban's rise in Afghanistan and the rise of militias, piracy, and illicit trade in Somalia demonstrate that networks of non-state actors can effectively challenge sitting governments for power in weak and failing states. The hazards of increasing global economic interconnectedness, such as the recent U.S. financial crisis that reverberated through foreign markets, further challenge the resources and governance capabilities of all states. The major earthquake in Pakistan in 2006 demonstrated how natural disasters in weak and failing states require outside international assistance for relief provision in the face of governments that are unable to respond. Natural disasters of this magnitude threaten to become more frequent and extreme as the effects of climate change intensify.

Recent events may be signals of a shift away from state-based models of governance

This staff identifies several key signals that may portend a complex event: a shift away from state-based models of sovereignty and power projection. These include, but are not limited to: the rise of global interconnectivity, which precludes crises occurring in isolation; decreased disaster management and crisis response capabilities of governments; the proliferation of weak or failed states; the empowerment of individuals, non-state actors, and non-governmental organizations; and outsourcing of traditional state duties; and the augmentation in the capabilities of transnational networks. Economic and financial systems-level crises, climate-related disasters, and societal crises may quicken the pace of this shift.

These signals suggest that the growing pressures on traditional governance may have already provoked a shift towards new methods of securing national security. This shift could take one of three identified Trajectories: states may continue to pursue traditional modes of governance and security, even as their control erodes. States could cede a portion of their sovereignty to multilateral, intergovernmental organizations in order to better address shared challenges to governance. States could also attempt to regain power by implementing centralized control through autocratic measures. The Trajectories of this Complex Priority are described separately, and their most important component Future Contingencies of Interest are discussed at the end of this section. Analyzing these Trajectories as well as their possible interactions with the Trajectories of other Complex Priorities is essential to identifying the actions needed to address them and prepare America's response, should some of these some of these contingencies or trends reach critical tipping points.

Trajectories of Complex Priority 2:

Trajectory 2.1: Sub-State Groups Continue to Undermine State-Based Governance
Trajectory 2.2: Strengthening of Individual State Sovereignty
Trajectory 2.3: States Cede Power to Supranational Institutions

TRAJECTORY 2.1: SUB-STATE GROUPS CONTINUE TO UNDERMINE STATE-BASED GOVERNANCE

Traditional modes of power projection by states continue in the face of eroding control

The Trajectory toward a more powerful sub-national actor disables traditional means of conducting foreign policy and threatens the security of the nation-state. Security for a nation-state involves

representatives negotiating alliances, trade agreements, global human rights treaties, limiting the proliferation of weapons, safeguarding the environment, combating illicit markets and connecting global physical and virtual infrastructure. Since the nation-state paradigm works on the assumption that representatives are harnessing state power for the collective goals of the territory and its people, the introduction of a more powerful, self-serving actor who does not represent a territory and its citizens limits the state's ability to meet these collective goals. Additionally, the assumption of a state-centric model allows for external control over state action. Representative actors are susceptible to international pressure, such as trade sanctions and embargos, international laws and shows of military force. These external pressures do not influence non-state actors who lack a delineated territory, state capital, national currency, infrastructure, legitimacy and representative sample of the population.

The ownership of power is a zero-sum game. As non-state actors become more powerful participants in weak or failed states' politics, the ability for the United States to achieve its foreign policy goals decreases because the U.S. representative must negotiate with—and legitimize—several non-state actors to ensure continuity of a policy across a territory no longer controlled by a central government. Shows of military force against this type of de-centralized, agile enemy are far less effective than invasions of a state with an established border, leadership and infrastructure, without which the state may not survive.

It is a false assumption to conclude that nation-states are stable, hard targets. There are many exploitable weaknesses inherent in nation-state structures that do not exist for non-state actors. For example, in addition to being responsible for providing basic goods and services to their populations, which may stop providing labor or revenue, states must honor international treaties, respond to natural and human disasters, and conflicts outside their borders. Failure to comply with or uphold these international norms results in painful consequences to legitimacy or infrastructure. States are also subject to attack, often having centralized and high-profile targets, such as buildings, leaders or policies.

While states are vulnerable to a loss of power, non-state actors acquire power through successfully navigating change, through new technology, and through reciprocal interactions with black markets. First, change is a driving force for the rise of non-state actors: states that cannot adequately address change and guide their populations through it are more likely to face the threat of failure and a substantial loss of power. Second, technology plays an ambiguous role in this Trajectory, providing an accessible network to all participants and facilitating communication to disparate regions of the world. Third, laws prohibiting the support of black or gray markets will have little meaning for non-state actors. For example, in Somalia, the Islamic extremist group, Al-Shabaab, has seized power through the continued failure of the Transitional National Government (TNG). Recognized as a terrorist organization, Al-Shabaab is barred from the licit economy, allowing the proliferation of criminal gangs in northern Puntland and Somaliland, which in turn conduct black market piracy operations hundreds of miles into the Gulf of Aden. This provides the terrorists with access to

While states are vulnerable to a loss of power, non-state actors acquire power through successfully navigating change, through new technology, and through reciprocal interactions with black markets.

automatic weapons and a source of income and the criminal gangs become wealthy at the expense of the licit market. The result is two-thirds of the Somali population suffering a humanitarian crisis with only the international community to turn to.

There are several other indicators that sub-national actors are acquiring power, such as the proliferation of weak states, failing states, and the permutation of violence across traditional state borders. For example, the U.S.-Mexico border has seen a dramatic increase in the number of drug-related deaths every year. By November of 2008, over 5,000 deaths resulted from drug wars, more than double the count for the preceding year and more than the number of soldiers lost in many state-based civil wars.[3]

The current perception of a strong nation-state paradigm prevents states from recognizing that the problem of non-state actors is spreading. Policymakers often discard the problems of Somalia or Latin America as solitary, extreme cases of corruption, criminality and tribalism that will not replicate elsewhere. Yet, from terrorist networks in the Middle East, sleeper cells in Europe, transnational organized crime groups engaged in the arms trade, drug trafficking, white slavery and money laundering, to the increasing frequency of drug-related wars in Latin America, nation-states need to realize that subversion threatens their control over power.

TRAJECTORY SUMMARY POINTS

- Power is a zero-sum game: as states lose power, non-state actors acquire it.
- Non-state actors are more adaptive, flexible, and resilient to change.
- Relevant FCIs for this Trajectory include failed, failing or weak states, changes to social, economic or technological resources, and the response capability of nation-states to natural or man-made disasters.
- States fail to recognize the faint signals from FCIs because they view each case as a separate, isolated event instead of part of a larger movement.
- Non-state actors have little accountability to populations, which means that these populations are often the first victims of their control.

TRAJECTORY 2.2: STATES SEEK INDEPENDENTLY TO INCREASE THEIR POWER

States may take autocratic measures to secure their power

This Trajectory illustrates the possibility that future contingencies could induce states to take radical measures to secure their national security and regain their dwindling control over traditional functions. This staff acknowledges that the world today is too interconnected for states to resort to total isolation to reduce direct and indirect affects of global crises. There would need to be upheaval and many intermediate points before that extreme were reached. This Trajectory examines the opposite: a set of interacting contingencies that could cause states to take radical measures, whether resorting to autocracy at home or military force abroad, in order to regain their traditional function as the institution with concentrated power.

[3] James Blears, "Mexico's Drug Murders Double During Past Year," *Global Security*, 10 December 2008. http://www.globalsecurity.org/security/library/news/2008/12/sec-081210-voa02.htm

Challenges to governance in weak and failing states will have a spillover effect to more developed nations

The empowerment of non-state actors is giving rise to globally distributed threats, which are widespread and complex enough to challenge the capacities of strong states to manage and prevent existential threats from overtaking weak and failing states. The proliferation of technology makes the possibility that weapons of mass destruction will fall into terrorist hands an ever more realistic possibility. Multinational corporations, transnational networks such as terrorist groups and criminal gangs, and private individuals of high influence or resources may increasingly contest for power with sitting governments and traditional power brokers in weak and failed states such as Afghanistan and Somalia.

Weak and failing states are finding their power increasingly attenuated even as non-state actors rise. Weak and failed states in sub-Saharan Africa, the Middle East, and areas in proximity to the equator will likely bear the brunt of the initial effects of climate change, an especially formidable challenge given their limited capacities. A sustained economic crisis caused by climate change-related effects would put further pressure on the frail governmental capacities of weak and failing states, causing social dislocation, popular resentment, and more space for non-state actors to operate.

Developed states' governments may be unsettled by the inability of regional institutions to come together to create effective responses to international crises. Distaste for equitable contribution to multilateral security forces or alliances may continue. Increasing scarcity of natural resources could draw strong and weak states alike into conflicts. Extreme climate change may create overwhelming floods of refugees, leading strong states to militarize their borders in an effort to stem the influx.

A proliferation of threats will force states to undertake radical reforms

Such future contingencies would create enormous challenges for strong states as they attempt to manage their national security challenges, caused by the effects of failing states and increased power of sub-state actors. States may be induced to take radical or even autocratic measures to secure their power. Use by terrorists of weapons of mass destruction could likely lead to martial law in some developed states, but less extreme contingencies are also relevant. In the face of difficulties, governments could promote nationalist sentiments to maintain the cohesion of their polities. The Chinese government's encouragement and instrumental use of popular, anti-Japanese sentiment illustrates this possibility. States may also risk a loss of public support should the public disagree with police-state reforms, crackdowns on civil liberties, and central planning or state control of economies as governments attempt to re-centralize control. Sustained economic crises could radicalize widespread opposition to free trade, forcing governments to enact strongly protectionist measures or slow the effects of free trade agreements.

Governments must anticipate future contingencies and carefully calibrate their responses

As governments recalibrate their responses to challenges to their power, it is imperative for the U.S. Government to monitor the critical contingencies such as the empowerment of non-state actors, crises of government in weak and failed states, and technological innovations that have the potential to bring this Trajectory about. The United States must carefully calibrate its response to future contingencies in order to avoid acting drastically, hastily implementing uninformed policies, or compromising democratic freedoms.

TRAJECTORY SUMMARY POINTS

- States induce radical, authoritarian measures to maintain their traditional levels of power.
- Outside threats and nationalist propaganda solidify the state power base as the public turns inward.
- This Trajectory represents a series of uninformed polices that compromise democratic values.

TRAJECTORY 2.3: STATES CEDE POWER TO SUPRANATIONAL INSTITUTIONS

States may be strengthened through multilateral cooperation and the pooling of resources

A Trajectory towards a supranational convergence of power would enable states to more effectively address challenges that affect them all. Such challenges, such as transnational terrorism, the spread of disease, and global climate change, by their very nature demand adaptability. While states would be required to cede a significant amount of power to a collectively defined authority, pooling resources, security assets, and decision-making capabilities to create supranational governing or crisis management institutions would render them all stronger and better able to withstand challenges to their sovereignty.

Governments are increasingly unable to respond to transnational threats

Governments, including those that are considered to be developed and stable, are increasingly unable to respond to the challenges posed by sub-state entities and weak and failing states. The increased instability wrought by wars in and around failed states, combined with unpredictable refugee and displaced persons patterns, may lead developed and relatively stable governments to enhance cooperative border security and surveillance despite cost considerations. Such contingencies may necessitate security cooperation in such a way that states naturally and gradually, rather than forcibly and immediately, pool their sovereignty. This Trajectory is illustrated in the increased need for states to share intelligence information across borders. The rising cost of effective and adequate surveillance technology may move like-minded governments to collaborate on border security. A chief indicator of a moving and inevitable trend toward states' ceding sovereignty would be when states begin to completely share in the ownership of information in favor of gained security benefits.

Meeting security threats more effectively may require states to cede some of their power to multilateral institutions

Where states cede some of their power, sovereignty is shared, both by the individual member state and by its superior institution. At an evolved level, states may even combine border sovereignty and security to protect the collective. Within the borders established by these consortia, permeable, regulations would allow for the free movement of goods, people, services, and information while borders recognized as outside the consortium would become more restrictive as a means to protect the collective states from outside threats. The evolution of the European Union and the beginnings of a standing, combined army may be one symptom of this trend. Power would shift not downward to non-governmental organizations and private actors, but vertically through formal and

bureaucratic forms of multilateral governance. An ideal type supranational institution would be similar to a Parliament in style and form of democratic governance. The spirit of the United Nations would be drawn upon, albeit held together through legal agreements, bureaucratic elections, and enforceable treaties.

This Trajectory is different from Trajectory 2 in that power is derived from several states acting together rather than a single state or several states acting to maintain control alone. It is wholly opposite of Trajectory 1 because the state, under this scenario, maintains more of its power against non-state actors, albeit in a different form than before.

States must consider shared economic and environmental crises as well as security issues

A Trajectory trending toward supranationalism may not be driven solely by shared security concerns, but may include considerations of disaster management and economic stability. For example, the costs of disaster management, now increasing as a result of climate change and severe weather patterns, may forces states to form global-based means of addressing environmental challenges. Where environmental disasters increase in frequency, the speed with which this Trajectory takes shape would significantly increase. The economic crises that began in the United States credit market spread quickly around the world. States may find that coordinating their responses to fast-moving crises requires ceding some power to a multilateral institution that could facilitate a rapid response based on the will of the collective.

TRAJECTORY SUMMARY POINTS

- Pooling security assets and decision-making capabilities affords states a means through which to address policy challenges.
- The rising cost needed to counter internal instability and extra-territorial conflicts moves states. to cede a significant amount of sovereignty to supranational institutions.
- The European Unions offers a faint signal as to the possibility of this trend.
- Fast-moving economic and environmental crises further add to a supranational urgency.

RELATED FUTURE CONTINGENCIES OF INTEREST

- Initial effects of climate change inordinately affect weak and failed states
- Threats to state sovereignty move states to enact authoritarian measures to maintain control
- Supranational mechanisms offer successful security policy responses
- Unsuccessful shift from fossil fuels to alternative energy causes economic and governance collapse throughout weak and failed states
- Accelerant technological innovation empowers transitional networks vis-à-vis states

COMPLEX PRIORTY 3:
SOCIO-ECONOMIC FRAGILITY

"West Africa is becoming the symbol of worldwide demographic, environmental, and societal stress, in which criminal anarchy emerges as the real 'strategic' danger. Disease, overpopulation, unprovoked crime, scarcity of resources, refugee migrations, the increasing erosion of nation-states and international borders, and the empowerment of private armies, security firms, and international drug cartels are now most tellingly demonstrated through a West African prism. West Africa provides an appropriate introduction to the issues, often extremely unpleasant to discuss, that will soon confront our civilization."

Robert D. Kaplan. "The Coming Anarchy." *The Atlantic Monthly* 273, No. 2 (February 1994): 44-76.

Globalization has left the United States vulnerable to social and economic disruption

Increasingly, physical distance between individuals holds little significance in terms of socio-economic systems. Globalization has increased the interconnections among individual economic and social groups resulting in a "flattening" of human organization. Groups and units interact with each other across great distances with consequences for the entire system. Billions of lives are affected each day by global financial transactions and trade, the Internet, the news media, and the images of western popular culture. The economic power of the largest multinational corporations exceeds or rivals many nation states. The influence of American culture is unparalleled.

Traditional responses are failing to anticipate or avert crises

While this staff would agree that globalization has had several genuinely positive effects for humanity, we are also painfully aware of how truly sensitive global socio-economic systems are to shocks. As the current global financial crisis demonstrates, socio-economic systems are in fact quite fragile. We have barely started to grasp the depth of the crisis let alone identifying the interactions among global economic and social systems most important for solving it.

Events over the next 5 to 10 years will have profound effects on global social and economic order

To be sure, our conceptions of state, economy, and social groupings will undergo some pretty important and basic changes. Already, an unforeseen result of the economic crisis has been an increased role for states in regulating economic and business activities. Central Banks and treasuries have undertaken a massive nationalization of financial institutions in the hopes of averting collapse.

Recent events are merely a prelude for major change

We could remain trapped in a cycle of economic stagnation that lasts a decade or more. We could soon find ourselves in a world far worse than even the direst forecasts suggest. In such a world, the bleak vision of Robert Kaplan's "The Coming Anarchy" might come to pass. Alternatively,

technological advances and strengthened financial governance could have very positive effects that help the global economy avert collapse and create a real sense of "global community."

These Trajectories, presented in detail below, represent distinct paths within this Complex Priority along which the United States could travel. They are not intended to be exhaustive but rather to illustrate diverse results of likely interacting contingencies which deserve further study. By considering some engagement opportunities that could keep the United States moving along a specific Trajectory or allow it to veer off on another, we can formulate better policy responses to the socio-economic Complex Priority.

Trajectories of Complex Priority 3:

Trajectory 3.1: Socio-Economic Collapse
Trajectory 3.2: Sustained Instability
Trajectory 3.3: Socio-Economic Durability

TRAJECTORY 3.1: SOCIO-ECONOMIC COLLAPSE

A series of cascading system failures leads to the breakdown of socio-economic systems

This Trajectory demonstrates that the interconnectedness of future contingencies such as a sustained global economic crisis, dramatic changes in population demographics, and increased armed conflict and terrorist attacks could lead to a series of debilitating shocks to socio-economic systems. This staff does not feel a complete breakdown is likely, yet the combined effects of these contingencies could lead to widespread economic failure and radical shifts in beliefs and values among both U.S. and international populations. This Trajectory outlines several future contingencies whose interactions would result in the inability of governments and the free market system to meet societal needs. In a worst-case scenario, we fear socio-economic collapse could lead to the rejection of democratic governance.

A sustained decline of national and global GDP could start a chain of events that would permanently erode standards of living. Funding for welfare programs would lessen steadily with GDP, causing rates of homelessness, unemployment and disease to jump. These severe conditions could then precipitate an international economic pessimism. As financial concerns worsen, consumers will severely curtail spending.

Reduced consumer spending would rationalize the return to cheaper, non-renewable fuel sources. Combined with an inability of corporations to invest in green technologies, this would greatly exacerbate the effects of global warming, placing much more stress on developed and developing nations, and increasing the impact and rate of scarcity of resources. Without adequate revenue or a reliable market, governments would have no recourse but to default on their debts and attempt to begin with a clean slate. On the international level this would likely be coincident with a complete breakdown in trust and withering of multilateral relations and inter-governmental communication.

Synchronously with this drop in GDP, increased life expectancy in developed countries would further stretch economic and welfare systems, amplifying the deterioration of citizen confidence in government and free markets and changing traditional social structures. Extended

families might begin living together in closer quarters than traditional in the American household. Society would be rearranged as the age of marriage and childbirth shift. Societies would have difficulty coping with an aging population and ever dwindling prosperity. Politically, intergenerational rivalry would heighten tensions as seniors' rights and political movements would compete with younger generations for government resources.

Transnational Corporations become more powerful than state actors in many sectors. At this point, states will no longer have the capability to manage economic activity. As private institutions and individuals lose confidence in the government's ability to meet their needs, they will turn to corporations to fix the economy.

Without effective government regulation, this would promote a chaotic economy, allowing the largest companies to act as they wish and bypassing both the built-in supply-demand controls of free markets and accountability to consumers. Standards may suffer, and consumers would bear the brunt of the costs as the giants collude and abuse market powers.

As states become unable to afford traditional warfare, a new form of inter-state war resembling terrorism could emerge, leading to widespread, large scale violence throughout the developed and developing worlds. This would exacerbate both existing inter- and intra-state conflict. This new form of war would challenge our ways of responding to violence, including the redistribution of human capital and the development of new advanced weaponry and surveillance technologies. The global economy could only be further destabilized by the increasing number of failed and weak states and these seemingly 'random acts of violence'.

Resulting long term unrest would likely lead to a drastic rise in civic violence, taxing domestic governments. Military and police forces would be stretched thin as civil society is displaced by rioting, black market economies, and crime. Individually motivated violence could create a negative feedback loop, leading to more frequent terrorist acts in support of economic goals. Individuals will place greater priority on their own survival, protection and security and form small groups based on ideology, race, family ties, or location to decrease dependence upon unreliable governments.

The terrorist acquisition and use of Weapons of Mass Destruction – nuclear, chemical, biological, or radiological – against Western interests also has the potential to disable traditional social and economic structures. Massive loss of life would lead to a global lack of human capital that impacts production across the globe. Security concerns and lack of confidence would negatively affect banking and investment. The resulting loss of wealth and capital, both human and intellectual, would be enormous. There would also be strong demand for greater defense and security spending.

In summary, a dearth of economic resources and prolonged uncertainty could lead to violence and pressures to reorganize world order. Finding ways to stabilize the global economy, allay citizens' fears and preempt these cascades is an immediate priority.

TRAJECTORY SUMMARY POINTS

- Socio-economic collapse could lead to the rejection of democratic governance
- Increased life expectancy from biogenetic advances could cause a basic reordering of societal structures and lead to intergenerational rivalries
- The rise of multinational corporations has the possibility to undermine economically impotent governments and depriving populations of basic human services

- Better and more effective forms of monitoring will be necessary for early identification of conflict
- Commitment to and leadership within multilateral and bilateral Non-Proliferation regimes is a necessity for managing the risk posed by WMD

TRAJECTORY 3.2: SUSTAINED INSTABILITY

Systems reach a new equilibrium characterized by the presence of inequalities and uncertainties

This Trajectory explores the possibility that the continuation of current trends, such as the rise of the Brazil-Russia-India-China (BRIC) economies, a decrease in U.S. military presence overseas, the persistence of intra-state conflict in Africa, and climate change and resource scarcity, could cause a new equilibrium of the global economic system, one that is characterized by chronic uncertainty. Past events have shown how the benefits reaped by increasing social and economic interdependence are also accompanied by the distribution of weakness across participating economies. This Trajectory posits that rather than returning to a state of prosperity seen prior to the current economic crisis, it is a distinct possibility that the global system would settle into an equilibrium characterized by the simultaneous pull of polarizing forces and the presence of inequalities and uncertainties.

Continued growth in developing nations would lead to emerging multipolarity. As more nations achieve equal economic power, U.S. economic influence and prestige would fade. If India and China move more strongly to promote their products and lifestyle, socio-cultural aspects of globalization will take on a more international and less "American" character. Cross-national migration of workers will further blend cultures and economies, causing both costs and benefits in the short, medium, and long term.

An increased tilt towards multipolarity would also re-arrange the global security and power structure as gains in economic power correlate with gains in political leverage. As a result, the United States would be forced to accept more compromises in the international arena, necessitating a less unilateral stance on security and other policy issues. However, there are domestic benefits to be gained from the more stable global economy and the variety of markets that multipolarity might provide. The United States could reduce its international commitments and reduce its spending practices accordingly.

Achievement of domestic policy goals, such as the reduction of overseas military commitments by the United States in Europe, the Middle East, and Asia, would reinforce the trend towards multipolarity by bolstering the perception of a decline in U.S. power. The shift from a wartime economy would jolt the domestic economy even as redeployment of U.S. troops domestically provides a significant boost to morale and allows a decrease in defense spending. Despite this, continued military and technological superiority and domestic prosperity would allow the United States to remain a strong and generally dominant presence in world politics. The challenge to the United States would be to gauge and manipulate these two countervailing perceptions of its power in policy formation and world relations.

Continued internal conflict in developing nations, especially sub-Saharan Africa, also has the potential to impact the United States' ability to promote international security and domestic policy goals. Conflict in Africa continues to destabilize the global economy, skewing the distribution of resources and providing safe havens for terrorist activity. To address these issues, more international intervention is required as prolonged conflict may prove to be too much for the limited resources of African Union member states. The United States may be forced to re-evaluate its cutback in military commitments against the possibility of regional instability leading to state collapse, risking another Iraq or the possibility of continent-wide state failure.

The United States must consider the possibility that global climate change will continue unabated as efforts to shape its path prove ineffective. Environmental factors continue to be economic destabilizers all over the globe. Some consequences are universal, while others are more regional. Acid rain grows progressively stronger, decimating agricultural production and increasing resource scarcity. Rather than seeking to stop climate change, a shift is made towards creating technologies that allow humanity to live with its effects, such as breathing contaminated air or neutralizing acid rain.

A shift in focus towards efforts to develop this technology will provide a temporary boost to the United States economy, but it will also put a strain on research into alternative fuel sources, further depleting non-renewable resources.

In summary, continuation of current trends would necessitate hard choices as citizens and policymakers adjust to a world where the United States will see a reduction of the leverage with which it pursues international interests. To meet these challenges, policymakers will need to be able to recognize and adapt to the opposing pressures exerted by this new equilibrium, and comprehend a system in which the United States dominance can be neither assumed nor assured.

TRAJECTORY SUMMARY POINTS

- Growth of global markets could lessen U.S. economic and political power internationally
- Domestic goals may be in direct conflict with maintaining a strong, international presence
- Global Warming might be impossible to stop; relevant policies should be adjusted accordingly
- Continued conflict in sub-Saharan Africa will require a difficult choice between non-engagement and overseas involvement to preserve global stability
- The United States can no longer assume or be assured of global dominance and must adjust diplomatic measures accordingly to achieve its goals

TRAJECTORY 3.3: SOCIO-ECONOMIC DURABILITY

Positive multilateral trends strengthen global and national socio-economic systems

This Trajectory towards multilateral cooperation highlights events that could strengthen national and global social and economic systems. As multilateralism is founded upon shared values and beliefs that underpin our socio-economic systems, the channels it opens transmit common desires between societies. This Trajectory forecasts that an environment of increased international cooperation among governments will seep into national dialogues and strengthen national and international relations across all levels of society. This staff asserts that continued fragility of socio-economic

systems undermines the ability of the United States to manage challenges with the necessary scope and attention to detail. Multilateral governance will be able to provide the information gathering and decision-making resources necessary to address the above contingencies in a coherent and effective fashion. The Trajectory focuses upon successful management of the following contingencies: challenges to the existing international economic structure, successful management of advanced technological developments, successful management of global warming, and resolution of ethnic conflicts.

This Trajectory must begin with the current economic crisis. It is exactly the type of event that this staff intends to forewarn. The current economic crisis could force states to rewrite the rules of international finance and create supranational monetary regulatory solution. At the center of the current crisis is the failure of national, supranational, and inter-governmental financial regulatory institutions. The regulatory systems of the United States, the European Union, and even the International Monetary Fund, were incapable of warning governments or corporations of the current crisis.

As this event is in the process of unfolding, we can only look at the missed signals. The failures of the Washington Consensus were not sufficiently addressed. The time-consuming deliberations of the Basel conferences on international finance regulation only gave the impression of addressing pressing matters. Observed usage of common phrase like "global economy" and lack of usage of a complementary phrase like the "global regulatory structure." Mission creep at the International Monetary Fund has extended the Fund's priorities.

The inability of any given country to allocate financial resources and manpower to combat global warming could force states into adopting a multilateral stance. No problem demands cooperation more than reducing carbon emissions. The potential problems cascade across all fields. Pollution causes respiratory problems, which impacts health care costs. Ice cap melting causes the sea level to rise, which impacts the productivity and habitability of coastal areas. Warmer waters cause severe weather which impacts trade and shipping. Changing climates cause water resource competition, which leads to ethnic conflict. The list goes on and touches on every element of social and economic systems.

It is a foregone conclusion that no individual states have the manpower, financial resources, or determination to manage these problems alone. Multilateral efforts will therefore shape the response to global warming. However, multilateralism could lead to a cabal of advanced nations controlling and implementing advanced technology at their own will and discretion to the detriment of less-advanced countries.

Discoveries and advances in the fields of nanotechnology and molecular manufacturing will challenge fundamental concepts of economic and social systems. Market use of these technologies will replace traditional forms of industry and challenge basic conceptions of society and economy. Capitalism could be thrown into chaos as products are no longer able to be priced according to production cost. Unemployment on the scale of millions could lead to societal unrest and conflict. It is therefore imperative the United States be at the forefront of developing and regulating these technologies. Idealistically, effective technology transfer throughout the world and the education of populaces would help prevent conflict.

However, the susceptibility of these technologies to misuse will prevent their proliferation. In the case of massive global social unrest from deprived countries, multilateral institutions and

mechanisms would be an effective method to transfer and educate populaces on the capabilities of these technologies. Nanotechnology and molecular manufacturing also have the capability of becoming prime tools in dealing with global warming as they could replace conventional, polluting methods of production. Policymakers would need to become informed of the benefits and risks associated with the actualization of these technologies.

Resolution of inter-state and intra-state ethnic conflicts could precipitate collaboration across other fields of interest. Peace often encourages an increased engagement in commerce and governance. Conflict is the first roadblock to grappling with more complex problems of economics, combating environmental degradation, and developing advanced technologies. Even as advanced industrialized states are grappling to adjust to financial, environmental, and technological change, they would work to resolve ethnic conflicts. Ideally, states would set aside differences in order to bring more focus to these issues.

In summary, these contingencies create enormous challenges for the United States as we would have to manage major changes to social and economic organization. We must remember they co-exist in a fluid environment where interactions arise in unknown areas and at unpredictable times. Fortunately, we will not have to manage these contingencies alone. Several contingencies suggest increased multilateral collaboration as an effective response to the challenges they present. We must focus attention on taking leadership and responsibility in the multilateral arena. For our efforts to be effective, that may require working with a smaller network of relevant and interested partners rather than through the United Nations system.

TRAJECTORY SUMMARY POINTS

- Responsible U.S. leadership and management in the multilateral arena will attract resources that have the potential to resolve significant global problems
- We must continue to learn about faint signals as we watch the current economic crisis unfold
- The Financial Collapse and Global Warming will demand international responses that we must lead
- Advanced technologies must be monitored closely to manage for their system changing effects
- Ethnic conflicts must be resolved to enhance multilateral cooperation and effectiveness

RELATED FUTURE CONTINGENCIES OF INTEREST

- Addressing Violence and Intra-state conflict becomes pivotal point of international and domestic policy.
- Drastic change in Economic structures and sectors of power
- Governments agree to a new framework for an international financial system with the authority to monitor and regulate an international monetary policy
- Fear of a cataclysmic environmental event pushes governments toward multilateral collaboration to combat global warming
- Advances in nanotechnology and molecular manufacturing will challenge social and economic systems.
- Desire for socio-economic stability supersedes ethnic rivalries and pushes towards the resolution of conflicts.

VI. Trajectory Analysis and Interactions: Integrating Theory and Policy

Theory

Having outlined our model for conceptualizing Complex Priorities, we will now demonstrate how Trajectory Analysis can help policymakers to better engage complexity and minimize crisis management and reactive policymaking. Long-range and wide-angle perspectives are necessary when implementing policies that could potentially undermine U.S. interests.

A **Trajectory** is related to a **Scenario** in so far as both seek to understand future events. It will describe multiple future contingencies in a single, realistic narrative. In addition to assisting with our understanding of future events, a Trajectory focuses on finding **Engagement Opportunities** -- or places where action may be taken -- to alter the direction, velocity, or magnitude of an approaching event or trend.

Trajectories represent possible movements of real events or trends. They do not exist in isolation. One may interact with another. Interactions between two or more Trajectories could trigger or intensify the relative magnitude and immediacy of approaching events. These interactions, when understood, produce signals that can be detected.

Policymakers could use these identifiable signals to determine the desirability or undesirability of current and approaching events. Following such a determination, more relevant policy choices could be evaluated.

Practice

For illustration purposes, we will now look at Complex Priority 1 on the Fragility of U.S. Management of Accelerating Technological Innovations. Specifically, we will advocate that the United States should attempt to steer away from the detrimental Trajectory, "Failure by government systems to successfully manage scientific advancements." We will show how this Trajectory interacts with the "Empowerment of Non-State Actors," which is identified as a Trajectory in Complex Priority 2: The Fragility of the State-Based International System.

The acceleration of technological innovation has already had a well-documented democratizing effect on global power dynamics. One only needs to look at the 2006 war between Israel and Hezbollah, in which the latter, a militia, acquitted itself more than admirably against the best-equipped and best-trained army in the Middle East. From machine guns to cybercrime, technology increasingly acts as a force multiplier that vastly increases the threat of individuals far beyond what they would otherwise present.

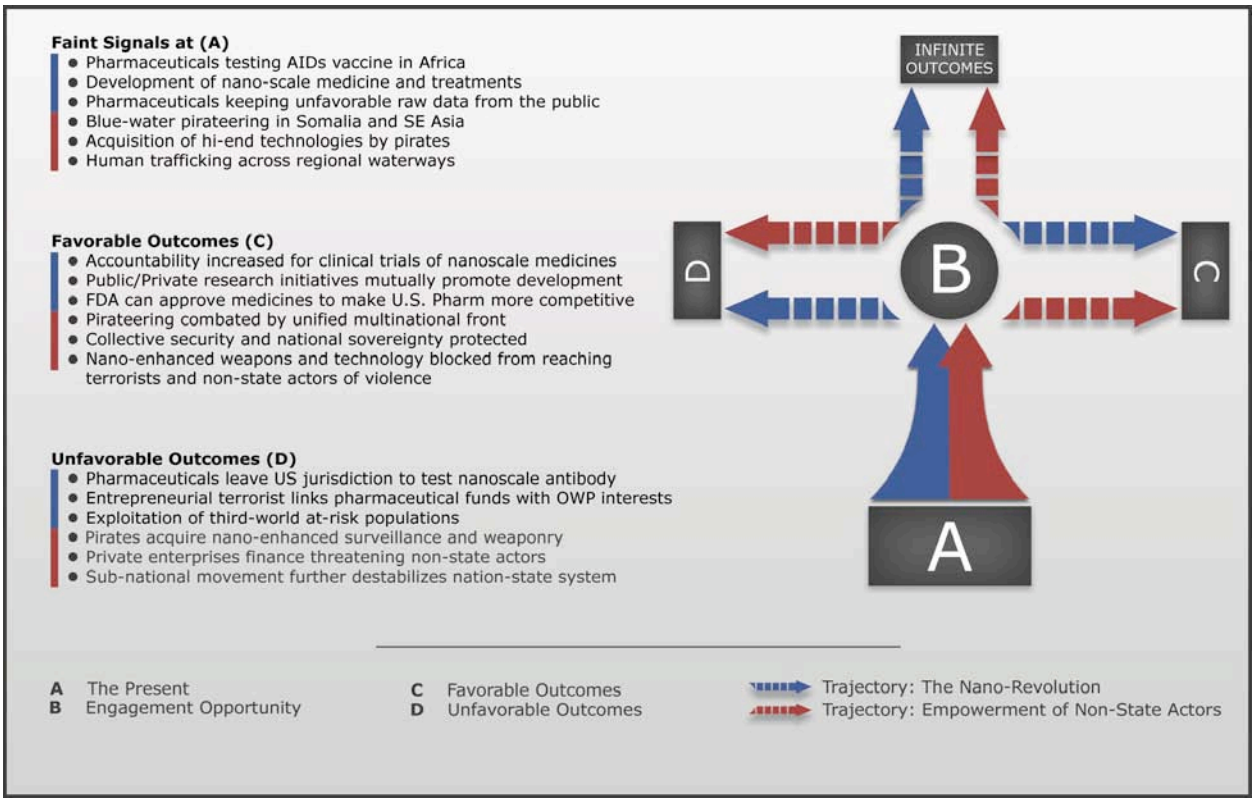
Now imagine a future where poor U.S. management of developing nanotechnology allows the development of this field to spin out of control even as its true potential begins to be realized. The

unregulated proliferation of nanotechnologies, which could include anything from cheap supercomputers to ultra-thin cutting implements to nano-empowered weapons, would further increase the independent power of non-state actors vis-à-vis the state.

As individuals are increasingly empowered by unregulated nanotech innovations, it is not unreasonable to project a concomitant increase in the difficulties that the governments of weak and failing states face as they attempt to project sovereignty and control over their affairs. One likely result would be an increase in lawless acts such as piracy that already occur with increasing frequency in and around weak and failed states. World piracy is on the rise. Recently, bold North African pirates ventured hundreds of miles out to successfully hijack an enormous Saudi oil tanker. This feat succeeded through the use of a variety of technologies that have arisen over the last several decades. These include GPS navigation systems, night vision goggles, satellite radios, etc.

It is unsettling to speculate about how much more effective such groups might be if they possessed computers, weapons, or other implements empowered by nanotechnology. The new and dangerous threat of proliferating nanotechnology could create a widespread crisis of security and governance in the weak and failed states that are the worst-equipped to deal with such threats. Yet such a breakdown in governance would only make any attempts to regulate these technologies. Thus, it is possible to imagine these two trends creating a vicious, closed-loop cycle in which accelerating technology undermines governance, which increases the demand for this new technology. These mutually reinforcing trends are illustrative of the possible dangers of interacting Trajectories and show why Trajectory analysis has the potential to be such a powerful tool for forecasting.

Figure 4: Trajectory Analysis



This example illustrates two **engagement opportunities:**

1. **Stricter FDA oversight over the clinical testing of nanotech influenced medicines.** [For an example of this, see: NIH-DOE Ethical, Legal, and Social Implications (ELSI) of Human Genome Research[1]]

2. **Early action against worldwide blue-water piracy by supranational mandate.** [For example, UNSC Resolution 1846 (Dec. 2nd 2008)[2]; Japan Maritime Center (JMC) collaboration with regional maritime authorities in creating a joint-international force against piracy in the Malacca Strait[3].]

In summary, Trajectory analysis gives policymakers a deeper understanding of the issues to arrive at policy choices that are informed and whose second and third order effects, though not entirely knowable, are more likely to be beneficial to the United States.

Performing such detailed analyses of all possible interactions of Trajectories is currently beyond the mandate of this panel. Nevertheless, its usefulness deserves further study. The next section of this report will address this staff's recommendations for the further integration of complexity considerations into government.

VII. RECOMMENDATIONS

Improving Our Engagement of Complexity

The methods of analysis outlined in this report will improve the ability of the U.S. Government to comprehend and engage complex reality. Improved comprehension must correspond with improved policies aimed at helping the Government better anticipate and respond to critical trends and future contingencies. Yet, this staff concluded in the course of its research that the traditional management structure of the interagency process is ill suited for managing Complex Priorities. Accordingly, complexity analysis must be paired with reform of the interagency system.

A better interagency mechanism is necessary to carry out this analysis and generate effective policy responses. At present, the interagency process is inefficient, overly hierarchical, and inflexible. It poorly integrates information and resources, and obstructs innovation. Participating agencies focus on their core missions and do not reward their officials for engaging in the interagency processes, and interagency policymaking is often under-resourced and. The result is an interagency system that often functions ineffectively, to the great detriment of our ability to anticipate and engage contingences in the medium to long term.

This staff is not unique in concluding that the U.S. Government's interagency processes are insufficient for the challenges that we face today. There is a growing consensus within the policy community that the current interagency process is in desperate need of reform[1]

The President's endorsement of the recommendations by the Project for National Security Reform (PNSR) that call for interagency reforms has created both a model and a moment to put this staff's techniques into action. Over the six months since this staff began its work, the President has called for a comprehensive overhaul of America's national security system, prioritizing the reform of the interagency system. Specifically, the President endorsed many of the recommendations that PNSR proposed for modernizing and improving the U.S. national security system and its interagency functions.

This staff endorses PNSR's recommendations for interagency reform. Furthermore, we submit that such new interagency mechanisms have the potential to effectively utilize the analytical techniques that this paper outlines to provide effective input into the policymaking process.

In addition, this staff makes the following recommendations to the DCOM:

1. **The President should create three task forces to manage the Complex Priorities identified in this Report:** socio-economic fragility, the revealed fragility of the international state-based system, and the nano-revolution and the management of scientific advancement.

2. **The mission of these task forces is to analyze these Complex Priorities in depth, generate important Trajectories and scenarios, and offer policy recommendations regarding them.** These task forces will serve as trials of both our new method for analyzing complexity and PNSR's recommendations regarding the interagency process.

Comprehensive reform will be a multi-year process at best. If successful, this task force can serve as a model for further reform.

3. **The task forces should report to the PCOM, and the National Security Advisor (NSA) should oversee them.** The oversight role will be to provide accountability and guidance, not micromanagement, and will not put an undue burden on the NSA. As task forces proliferate and the task force model becomes integrated into the national security structure, it will be necessary for the NSA to delegate oversight to lower levels of hierarchy, but the NSA should directly supervise the initial task forces.

4. **These task forces should be empowered to:**

    4.1 Engage in rigorous analysis;
    4.2 Maintain a dynamic organizational structure;
    4.3 Engage in decentralized problem-solving and innovation within the parameters of their mandate;
    4.4 Maintain accountability through oversight of a designated individual;
    4.5 Coordinate human and financial resources, instead of dividing it; and
    4.6 Make policy recommendations directly to the PCOM.

5. **Task forces should have sufficient resources to pursue their mandate.** This should include a small staff that can support the task force and help provide institutional continuity through personnel changes and additions.

6. **Effective leadership is essential.** The individual who directs each task force must be a visionary official with good management skills and one who can maintain focus while encouraging innovation. He or she should have demonstrated success managing a decentralized, flexible group. The leader should use judicious interventions to help guide the broad direction of the team, maintain accountability, and resolve internal disputes without engaging in micromanagement that would discourage creativity and innovation.

7. **These task forces should engage pertinent agencies, but should retain control over their own staffing.** It is imperative that these task forces have freedom and flexibility to self-organize and determine their composition in support of their respective missions. The number and background of each task force member should be determined by the task force on an ongoing basis, with the oversight of the NSA.

8. **The task forces should engage outside experts.** The task forces should upon expertise in government, academia, nongovernmental organizations, and the private sector. While the issue of classified information creates a potential difficulty, each task force should have a designated staff member that

9. **The President should mandate that effective interagency work is expected and will be rewarded.** Agencies currently focus on their core missions to the detriment of interagency work. While PNSR's reforms include this measure, it could be years before all agencies create effective incentives for interagency work. In the meantime, the President should order the Executive Branch agencies to make clear that participation in interagency work will be rewarded, much as the State Department did when it told reward Foreign Service Officers reluctant to serve in Iraq that this service would help advance their careers.

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VIII. APPENDICES

APPENDIX A: THE CARLI CHART

The CARLI chart (see the following page) is a tool for tracking interactions among Future Contingencies of Interest within a specific Complex Priority. The CARLI chart (Comprehensive Aggregation of Relationships and Linkages among Interests) is an enhancement of the STEEP analysis method[4] specifically tweaked to highlight relationships and linkages not readily apparent.

CARLI is intended to be a blunt analytical instrument for Forward Engagement analysts to visualize complex interactions that cascade across categories and contingencies.

Across the top of the chart are the STEEP categories (Social, Technological, Environmental, Economic, and Political). Down the side of the chart are measures of "Reinforcing", "Neutral/Sustaining" or "Conflicting".

- Sustaining interactions mean that the FCIs continue along their present path with no significant change in direction or velocity.
- Reinforcing interactions mean that the velocity or magnitude increases.
- Conflicting/countervailing interactions describe opposing forces and produce a decrease in velocity or a change in direction.

The chart is used in a similar manner as traditional STEEP analysis. For any given FCI, the analyst determines the impacts of the FCI in each STEEP category. Each of these outcomes is tagged with a number correlating to its FCI in the attached key. The analyst then determines whether the outcome falls within the Reinforcing, Neutral or Conflicting categories.

After populating the chart with several FCI's, relationships and linkages between effects of those FCIs that are currently only producing "faint signals" should become more noticeable. Drawing upon these connections, the analyst will be able analyze the relationships within each Trajectory of a Complex Priority, or even between Trajectories, depending upon the FCI selection criteria.

[4] STEEP analysis examines effects by sector: social, technological, economic, environmental, and political. STEEP analysis has been used by past staffs to evaluate individual FCIs.

Sample CARLI Chart for Socio-Economic Fragility

interaction type	Social	Technological	Environmental	Economic	Political
Reinforcing	Better informed and more responsible global citizens (2)		Potential to focus on collaboration in developing new technologies(2)	Likelihood of increased trade opportunities(2)	Potential to avoid military conflict in favor of negotiation (2)
	Improved social welfare (1)			New markets (1)	
	Increased individual value from meaningful employment (1)			Massive wealth (1)	
	Promotes social welfare (3)	Effective Technology Transfer is enhanced by accepted international mechanisms(3)			
	Improved quality of life (3)	Improved quality of life (3)	Slows environmental degradation in developing countries (3)	Wealth creation (3)	Creates stronger governments (3)
	Social mobility (3)			Employment opportunities (3)	political opportunity (3)
	Stronger more vibrant communities (3)				
Sustaining/ Neutral					
			New investment mechanisms (1)		
			End of fossil fuels (1)	Massive wealth (1)	Pressures on leadership to control access to renewables (1)
Conflicting	Distrust in foreign and domestic leaders if their decisions do not produce desire results (2)	Fear of sharing advanced technology (2)	Perhaps negative effects of increased travel as government officials are required to meet in more distant areas of the world (2)	Global regulation means no economies are safe from recessions or economic crises (2)	Potential deterioration of state governance structures (2)
	Society gorges on energy in a post fossil fuel economy (1)	Tech is focused on resolving problems only in industrialized countries, not in developing countries (1)			
	Could challenge accepted social mores and norms leading to social tension (3)	Stress on traditional occupations (3)	Creates new environmental problems not before encountered (3)	Potential of creating a new type of permanent poor (3)	More political competition is not managed effectively and leads to domestic strife (3)
	Anti-donor blowback (3)				

KEY:	FCIs
1	Renewable energy becomes affordable and supplants fossil fuel use
2	Confidence in Multilateral institutions leads to increased cooperation
3	Successful Investment in and Transformation of Developing Countries

APPENDIX B: ALTERNATIVE FUTURING TECHNIQUES[5]

Action Index:
An *Action Index* is a numerical value applied to an FCI in order to quantify the need for response. Borrowed from the Department of Homeland Security, and employed by the Spring 2006 Commission staff, the Action index considers:

1) Time line/horizon for the FCI; (valued 1.1 -1.6)
2) The probability it will come about; (valued 1.1 - 1.6)
3) Its potential impact (valued 1-10)

Action Index =
Impact x Probability x Time Horizon

The highest potential Action Index number is 160. For the first two, points are assigned as follows: 1.6 points (0-5 yrs), 1.5 points (5-10 yrs), 1.4 points (10-15 yrs), 1.3 points (15-20 yrs), 1.2 points (20-25 yrs), 1.1 point (25-30 yrs).

Projection:
Projection uses past and current trends to synthesize a series of potential future events. By analyzing linear trend progressions in various fields, projection seeks to provide a vague but directed picture of likely future circumstances

Prediction:
A prediction is a specific statement about a potential future event or set of events. Using trend projections to narrow the set of possibilities often generates predictions. While generating an accurate prediction is difficult and unusual, they can be valuable points of reference when thinking about the future.

Delphi Method:
The Delphi Method is basically forecasting by committee. The researchers solicit the opinions of a number of experts in fields relevant to the question and then compile the results. The idea is that greater consensus indicates a more likely future.

Scenarios:
Our predecessors generated and assessed scenarios in order to closely examine the potential outcomes of specific FCIs. Scenarios are detailed visions of one or multiple potential futures. They are devised by employing forecasting methods such as projection, prediction, and the Delphi method in order to illustrate specific future circumstances that incorporate one or a limited set of FCIs. Although not in the case of the Spring 2006 report, scenarios are often presented in groups of three or four 'alternate futures,' which a futurist or policymaker can use to assess which future circumstances are desirable or undesirable.

Positive / Negative Assessment:
Previous staffs assessed the potential benefits and consequences specific to FCIs. This analysis can provide policy makers with a qualified assessment that they can use when deciding how to direct policy. Although not utilized in our analysis, this staff identified three applications for this approach:

[5] Editor's note: These techniques were compiled by members of the staff of the U.S. House Annual Committee on Forward Engagement during the Fall 2006 semester.

1) Assessing the positive or negative implications of an FCI based on **bias, special interest** or **subjective position**. From our standpoint, this type of assessment would be geared toward determining the positive and negative implications that an FCI could have on U.S. interests and the longevity of our nation's government, people and way of life.

2) Assessing the *positive* or *negative* impact that **policy would have on the development of an FCI.** This assessment would show how specific policies could encourage or inhibit the progression and effects of FCIs. For example, we argue that a U.S. official definition of human life, which restricts certain types of research, can encourage the shift of power to Asia (FCI) as highly trained individuals will choose to relocate to countries where a looser definition of life allows for greater research opportunities. On the other hand, the U.S. implementation of a domestic policy to enhance privacy rights may render a negative impact on the United States' ability to respond to a pandemic due to limited access to health records.

3) Assessing *positive* or *negative* feedback**. Feedback describes the potential for policy to enhance or diminish in effectiveness over time.** Positive feedback describes a situation where the effects of policy are aggrandized; negative feedback is the reverse, whereas policy becomes less effective as time passes.

APPENDIX C: FCI COMPILATION

Note: It is impossible to represent every FCI that exists, but this is a sample list compiled from current events, past research, intuition and observation.

Biological Weapons, Defense and Warfare

Bush Administration's Expectations for Post-war Iraq

Failure of Campaign Finance Reform

Technology, Wage Deflation and Social Instability

Embryonic Stem Cell Research

Intervention Policy in Columbia

Future of Japanese Demographics

Economic Forecasting

Theory of Hegemonic Stability

Development Economics and the Washington Consensus

Computer Technology Projections and Government Policy

Economic Projections for FSU Countries: Demographic Implications

Energy and Emissions Projections for China

HIV and the Military

Democratic Peace and the Future

Revolution in Military Affairs

Failure of the U.S. Dollar

Will Iraq Catalyze Democratization in the Middle East?

Multinational companies gain more influence and start conducting their "own foreign policy"

A standing European army

Global Warming causing an increase in Hurricane activity

Aging Populations

Growing Middle Class

State Capitalism: A Post-Democratic Marketplace Rising in the East?

Bumpy Ride in Correcting Current Global Imbalances

Multiple Financial Nodes

Diverging Development Models

Persistent Youth Bulges

Genetic Intervention in the Early Stages of Human Life

Evolution of Government and Society in post-Taliban Afghanistan

Evolution of Disparate Terrorist cells

Post Soviet Union Economics

Assessing Consequence of Export Control Reform

The UN Millennium Project

Scenarios Regarding U.S. Policy and North Korea

Sino-Japanese Relations

Impact of Computer Processing

U.S. Social Welfare Programs

U.S. Policy on Terrorism

Artificial Intelligence

Computing and Electronics

Chemistry and Biotechnology

Robotics

Physics and Astronomy

Nanotechnology

Military technology

Health Technology

Resource Wars

Religious Wars

Coping with Global food shortages

Criminal trafficking organizations increase black market trade

Nuclear fusion becomes a viable source of energy

U.S. Credit Implodes

Governance of weak or failed states by terrorist or militant organizations

Increase in regional or civil wars within failed states

Increased devolution of responsibilities to UN and NGOs, especially concerning peacekeeping operations

Video Surveillance and the impetus for domestic intelligence activity

Space exploration

Internet terrorism

Low-level armed conflict and the changing nature of warfare

Space weaponization

Relief as a weapon

Generational social values

Resurgence of Tuberculosis

The risk of global pandemic

Are modes of governance evolving?

Totalitarian rule in Africa

Fighting Corruption in the Third World

West-East financial market shifts

Impact of rare-species extinction on fragile ecosystems

Global travel and 'eradicated' disease

Social upheaval caused by dissatisfaction with unresponsive governments

Alternative Forms and targets of Terrorism

Ethnic or religious identity becomes more important the national identity

Increase in power of security firms due to outsourcing of military functions

Increased influence of multinational companies, which begin to conduct their "own" foreign policy

The successful evolution of the ESDP, NATO, or the WEU to incorporate both a common and dominant European security policy and a standing army or security force

End to welfare payments

Increased poverty and hunger

Global economic crises occur often and wreak havoc on populations

Decrease in global trade as protectionism increases

Economic planning occurs in Europe and the United States

Global Migration, Urbanization, and Ethnic Shifts

Changing demography in Russia, China, India, and Iran

Energy geopolitics

Surveillance increased and privacy restricted

Less openness and more secrecy among democratic governments

Mass movement of Palestinian refugees in the Middle East returning to Palestine

Failure of Chinese Communist Party governance due to demands of society

Increase in black market international trade

Vital resources become more scarce and inaccessible

APPENDIX D: FORWARD ENGAGEMENT: THE JOURNEY TO THE CURRENT THOUGHT

Forward Engagement aims at creating more effective long range policies. In order to achieve this goal, Forward Engagement has historically sought forecasting and futuring methods that allow better and more precise ways of anticipating future developments. Building upon the work of the field's pioneer, Leon Fuerth, staffs like this one have been operating under a mandate to further the concept and practice of Forward Engagement since 2001.

Simply stated, the research conducted in this field began with the assumption that by analyzing current events and future trends, it is possible to identify areas in which the special attention of policymakers is required. The ability to identify those areas will be crucial if policymakers are to enable the United States to retain its leading economic and military position. The 21st century is characterized by a multi-polar world fraught with emerging powers, especially in Asia. During the work of successive staffs throughout the past decade, the potential of Forward Engagement to uncover major threats to the national security, whose scope of definition has been broadened in the recent years, was brought to the fore.

In the initial report, the first staff tasked with Forward Engagement organized its work using topical substructures which identified future trends and categorized them in the following sections: state and governance, science and technology, military and security, and economics and finance. Recognizing the need to give some direction to policymakers to enable them to look beyond immediate concerns, a later Forward Engagement staff introduced the concept of nodes. This concept would allow policymakers to work with a more narrow focus on issues of interest, such as water scarcity or nanotechnology, in order to address them more precisely and with more efficient policies.

A further step in the methodology of Forward Engagement was made by the introduction of so-called "Future Contingencies of Interest" (FCIs), which reduced the aforementioned nodes to a sublevel of analysis, where they would be more manageable, and thus, more useful for policymakers. At the same time, the staff discovered the usefulness of STEEP matrices, which enabled researchers to detect possible consequences of interacting FCIs on a large scale, by considering the impact of each FCI on society, technology, economy, ecology, and politics.

Through continued research in the field of futuring, foresight and Forward Engagement, the current staff has now found a methodology that may readily be implemented in order to actively support policy and decision making processes at their highest levels. The methodology, which is introduced in this report, is capable of identifying crucial sets of interacting FCIs, so-called Complex Priorities. Having identified such Complex Priorities will give leaders the opportunity to anticipate the coming of potential crises in advance and understand their meaning in a larger socio-economic and political context, rather than simply reacting once a crisis has already occurred. This understanding is aided by the concept of Trajectories, sets of FCIs within Complex Priorities that indicate motion in a particular direction, in which societies and inter-state- relations are developing. Analyzing those Trajectories will enable policymakers to identify points of leverage, where they should implement policies in order to influence world affairs towards the most favored outcome.

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