The DCDC Global Strategic Trends Programme

2007-2036

DCDC

Third Edition

Strategic Trends: Introduction

Strategic Trends is an independent view of the future produced by the Development, Concepts and Doctrine Centre (DCDC), a Directorate General within the UK's Ministry of Defence (MOD). It is a source document for the development of UK Defence Policy.

> This edition of **Strategic Trends** is benchmarked at December 2006. It is a live document and will be updated regularly on our website as new thinking emerges and trends develop.
>
> Articles will be added to the website periodically to cover specific topics in greater detail.

Although extensive efforts have been made to verify facts contained in **Strategic Trends**, readers are cheerfully invited to inform the DCDC of any inconsistencies or inaccuracies.

Conditions of Release

The findings contained in this edition of **Strategic Trends** do not represent an official position of Her Majesty's Government or the UK MOD. The information is, however, Crown Copyright.

Departmental Direction

Strategic Trends is part of the UK MOD Strategic Context Process, from which the Department derives guidance about strategic challenges and opportunities, which is used to shape the UK's future Defence requirements. MOD direction on the DCDC **Strategic Trends** programme stresses the requirement for a comprehensive, independent approach:

> DCDC's **Strategic Trends** Programme should aim to provide a detailed analysis of the future strategic context for Defence out to 30 years. This will be an essential input into policy development and major outputs include:
>
> - A historically and theme-based analysis of the future strategic context;
>
> - Analysis of the key risks and shocks, including an assessment of their probability, frequency and magnitude;
>
> - Identification of the generic Defence and Security implications of this analysis.
>
> Building on previous editions of **Strategic Trends**, the analysis should adopt a comprehensive approach to the key drivers and deduce the salient themes out to 30 years. The analysis should also present a 'stock-take' of those developments likely to

be important at the 15 year point.

In compiling the analysis, the ***Strategic Trends*** programme should make use of a broad and diverse evidence base. Much of the value of the ***Strategic Trends*** programme derives from its independence from MOD decision-making and the aim should be to draw together thought and opinion from as wide a constituency as possible.

Contact Points

Contact details for the Strategic Trends project team are listed at page 89.

The Development, Concepts and Doctrine Centre

The Development, Concepts and Doctrine Centre (DCDC) is based on sites in MOD Main Building and at Shrivenham;

Mission

The DCDC will provide the intellectual bases that inform coherent decisions in Defence policy, capability development and operations, both now and into the future.

Principal Outputs

Provide cross-dimensional analysis of the future context for Defence out to 30 years.

Analyse, assess and articulate the framework within which future military capabilities and force structures are developed.

Initiate, formulate and validate concepts to shape coherent capability development.

Articulate and provide doctrine at the strategic, operational and Joint tactical levels that incorporates enduring principles and best practice.

Develop, articulate and promote the Defence role in crises and conflict as part of the multi-agency Comprehensive Approach.

Maintain legal compliance and sustain a favourable legal environment for Defence activity and capability.

Foreword by the Director General, Development, Concepts & Doctrine – Rear Admiral Chris Parry CBE

Introduction

I am delighted to present our independent **Strategic Trends** programme, which is our assessment of the strategic context out to 2036. It is the result of over a year's research by my team and me. The programme not only underpins and guides our wider work here at the Development, Doctrine and Concepts Centre (DCDC), but also informs the development of the United Kingdom's Defence Policy.

This document will be updated and refined on a regular basis as new evidence and thinking emerge, and will be available in both documentary and web-based formats.

Readers of the last edition of Strategic Trends will notice several substantial changes in our analytical method. Most importantly, we have refined our cross-dimensional approach to ensure that interactions between dimensions are thoroughly examined, together with the potential for significant shocks. Secondly, we have presented a range of divergent outcomes, derived from probability assessments, to indicate our confidence in something happening and the strength of the evidence on which judgements are based.

Rear Admiral C J Parry CBE

Understanding Change

In our analysis, we have tried to steer a measured course between the rocks of simplistic extrapolation from contemporary, emerging features and floating vague, meaningless generalizations and banalities about the future. Many commentators anchor themselves in the familiar present and, exploiting the latest fashion and a series of telling anecdotes, merely tell people what is already happening. Quite honestly, much of what we have to say, with regard to both continuities and discontinuities, does not have a conclusion or an ending, happy or otherwise, because, self-evidently, the future has not happened yet. What we offer are

robust judgements across various alternative futures, which concentrate on the challenges of the most likely future themes.

Despite the tendency of some to confront the challenges of the future on their own terms without the context of history and human experience, I make no excuses for maintaining an intelligent dialogue with the past to make some sense of the future. As the great English historian Edward Gibbon reflected:

> *'I have but one lamp by which my feet are guided, and that is the lamp of experience. I know no way of judging the future, but by the past'.*

With this in mind, we have been realistic. The future is characterised by a bewildering number of variables and all trends inter-relate with each other and inter-react in dynamic ways; some judgements are based on uncertain and limited evidence, others rely on political decisions, which can be reversed or accelerated, and all are vulnerable to unforeseeable events and the vagaries of human action. I am, anyway, conscious that there is seldom any reward for those who get the future right. As John Gray has said:

> *'People who worry about problems that others are not worrying about are irritating and are disparaged after the event. People who were right when others were wrong are even more irritating'.*

We believe that the future will happen as a result of long-wave themes and developments that unite the past, the present and the future. However, one constant evident in history – the power of contingency and surprise – will continue to dominate our future, which will be influenced and punctuated by unexpected events, startling surprises, major discontinuities and the pervasive operation of chance. Quite apart from these considerations, people and countries will conduct themselves in accordance with their social and cultural characteristics and their perception of their historical experience and future prospects.

Therefore, this piece of work seeks to identify and examine likely patterns in order to suggest reasonable broad-order possibilities and potential outcomes, whose risks, effects and extremes it might be necessary to mitigate or avoid. It is necessarily a rational attempt at objective, dispassionate assessment, but I would ask readers to remember that, to paraphrase von Moltke, parts of our projected landscape are unlikely to survive first contact with the future, mainly and inconveniently because of the tendency of human beings to interfere with the scenery and to act and react in unforeseen, non-linear ways. Nor do similar causes lead to similar outcomes; things are just too complex, with a great many variables, decisions and actions that interact with human behaviour in an almost organic manner. Indeed, discontinuities, insecurities and volatilities seem to be

proliferating all the time and future changes seem to be accelerating towards us at a faster rate than we might have expected.

Because of the difficulty of judging long-term outcomes in a rapidly changing world, our assessments are probability-based, rather than predictive; an exercise that is closer to establishing the odds on several runners winning a race, rather than gambling on a particular runner to win. Therefore, while we express clearly what we believe to be the most likely outcomes, we also provide assessments of lower probability alternatives. For example, a decline of confidence in globalized markets is possible and might cause international rivalries to intensify, increasing the risk of inter-state warfare. Therefore, while planning on the basis that major strategic powers have a shared interest in maintaining global economic stability remains reasonable, the need to understand the potential for conflict between them will persist.

The dynamic and fluid nature of the future strategic context demands that we also consider the potential for shocks that represent major discontinuities in what might rationally be divined. Most of the shocks that we have identified are based on plausible triggers: a mega-seismic disaster or the unintended outcomes of technological developments. Others, however, are highly conjectural, possibly appearing to some to verge on the fantastic. I would urge the reader, as a guard against scepticism, to consider in his/her own experience which shocks would have seemed likely 30 years ago.

I am aware that we may have overestimated the pace and effect of short-term change and underestimated the scale and nature of long-term change. My excuse is that it is difficult, indeed reckless, to imagine contexts that are fundamentally, rather than incrementally, different from the present, especially as the drivers of change are probably ones that have not been identified or understood yet. Consequently, we have sought the opinions of people who are expert in their specialist fields rather than those who profess to understand how the future will unfold.

Taken together, I believe that our work provides a complex, but readily discernible tapestry of outcomes, which should aid not only the Defence decision-maker, but also stimulate a wider audience. While this work is the product of analysis by the DCDC, it is only right to acknowledge the significant external assistance we have received and many contributors are acknowledged by name. I wish to express my thanks and appreciation to those who have helped us and look forward to continuing these highly productive relationships in the future and to developing new partnerships.

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Strategic Trends: Method

The Purpose of Strategic Trends

The need for Defence to understand the future strategic context was articulated in the Strategic Defence Review (1998), which confirmed the long–term nature of Defence planning and the need for a wide-ranging understanding of the complex strategic environment. **Strategic Trends** provides a measure of context and coherence in an uncertain predictive area characterized by risk, ambiguity and change.

The DCDC approach goes beyond identifying the potential future military threats to which our Armed Forces will have to respond, and looks at the developments in areas that will shape the wider strategic context within which Defence will have to interact. For example, the Study addresses subjects such as: access to resources, the evolving international system and developments in Society.

Defence decisions about how to act and react in relation to these issues are considered over time, with an appropriate balance of judgement and risk, and take time to form and implement. This is entirely proper because the consequences of these decisions tend to endure for some time. Weapon systems and platforms can take more than 15 years to design and acquire and may be retained in service for 20 – 30 years (some may in future run for up to 50 years). Other significant examples include the development of long-term Defence relationships, post conflict peace-building and sustaining the long-term personnel requirements of the Armed Forces. In addition, in terms of value for money and strategic resilience, Defence has to make a prudent assessment of those capabilities the Armed Forces will need to sustain a consistently credible military posture over time, while allowing some flexibility for the unexpected, and for rapid change.

One of the strengths of the **Strategic Trends** assessment is its independence from routine staffing and wider Defence decision-making. This helps to ensure its objectivity, intellectual rigour and freedom from accusations of compromise, lobby-group pressure or partiality. Consequently, **Strategic Trends** is able to inform Defence decisions, without being constrained by the latest good idea, fashionable trend or received wisdom. Some of the findings in **Strategic Trends** will, therefore, challenge views which derive from existing or transient circumstances, rather than from long-wave trends and from the enduring features of the strategic context.

Scope

Strategic Trends presents an understanding of the changes that are likely to take place during the next 30 years, by considering major trend-based outcomes in 5 dimensions:

- Resource.

- Social.

- Political.

- Science and Technology.

- Military.

Analytical Approach

The **Strategic Trends** approach starts by identifying the major trends in each of these dimensions and analyses ways in which these trends are likely to develop and interact during the next 30 years, in order to establish a range of **Probable Outcomes**. Nothing in the future is guaranteed, of course, and **Strategic Trends** varies the strength of its assessments to highlight sets of **Alternative Outcomes** that, while less probable, are nonetheless highly plausible, for example:

- By 2010, most people (above 50%) **will** be living in urban rather than rural environments. Poor housing, weak infrastructure and social deprivation **will** combine with low municipal capacity to create a range of new instability risks in areas of rapid urbanization, especially in those urban settlements that contain a high proportion of unplanned and shanty development.

- Alternatively, a less even process of globalization **may** lead to lower-density settlement patterns, with people straddling rural and urban-based livelihoods, resulting in extensive browning of the countryside.

Having established trend-based outcomes of varying probability, **Strategic Trends** articulates a number of specific **Risks** associated with each dimension to highlight the way some of the more adverse consequences could manifest themselves and affect Defence business.

Strategic Trends: Trend Analysis
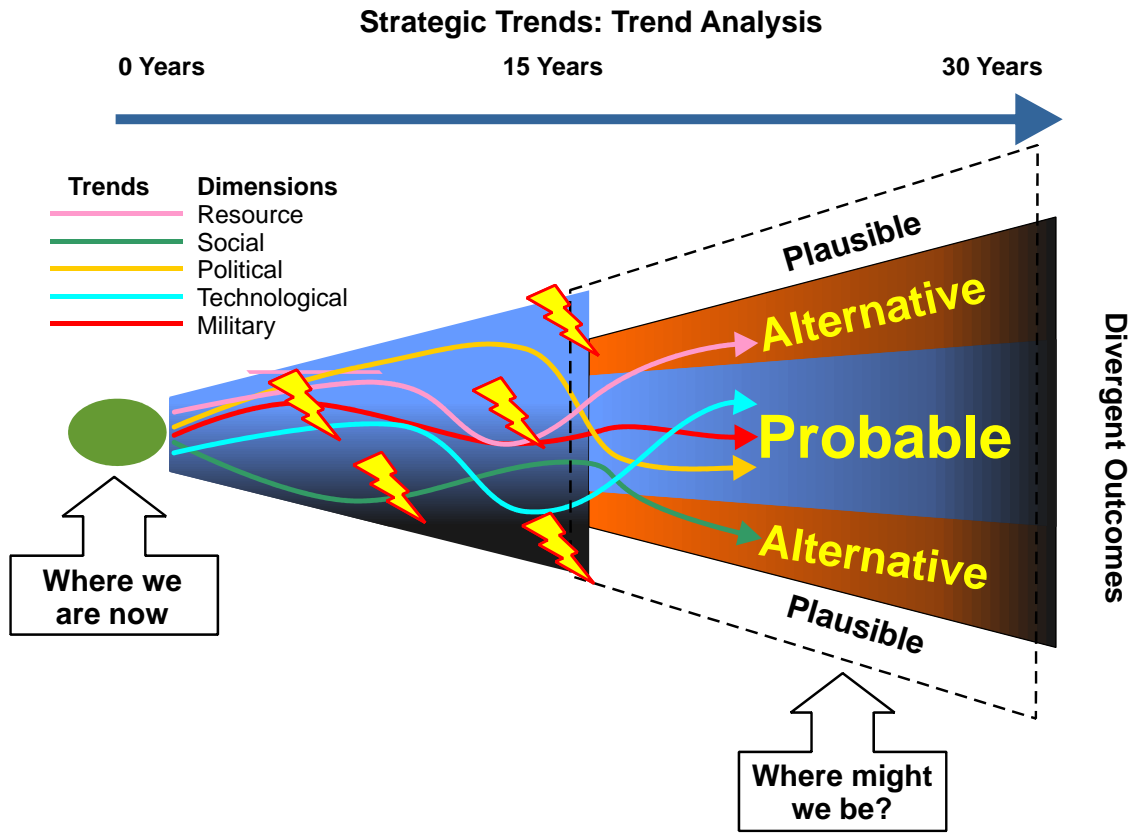
Figure 1 - Strategic Trends: Outcome Assessment

Strategic Trends then identifies significant ***Defence and Security Implications*** associated with the outcomes. These include a brief assessment of the security challenges that could arise and the general responses that might be required. Examples associated with urbanization include:

• It is ***likely*** that unregulated urbanization ***will*** result in future adversaries who have highly-developed urban survival and combat skills. They ***may*** consequently choose to pursue their objectives and conduct operations in sprawling towns and cities which ***will*** already have experienced endemic lawlessness and high levels of violence.

Having analysed a range of probability-based outcomes, the potential for major strategic discontinuities is considered by introducing contingent ***Strategic Shocks***. These are either, typically, very unlikely, or likely to occur at extremely infrequent intervals. Historical examples of the sort of discontinuity which the Strategic Shocks highlight include:

- The destruction of Minoan civilization as a result of volcanic eruption in 1450 BC.

- The impact of the Black Death on 14th century Europe.

- The attack on the United States in September 2001.

As well as establishing trend-based outcomes across the 5 dimensions (over 500 in total), **Strategic Trends** seeks to identify and interpret the likely pattern of change over the next 30 years. In doing so, it assesses that during this period human activity will be dominated and affected by 3 pervasive **Ring Road Issues:**

- Climate Change.

- Globalization.

- Global Inequality.

In order to provide a coherent framework and to achieve a systematic understanding of possible human responses to these and other drivers of change, **Strategic Trends** has synthesized its trend-based outcomes within 4 global **Key Themes**:

- Population and Resources.

- Identity and Interest.

- Governance and Order.

- Knowledge and Innovation.

These groupings allow the derivation of outcomes from key drivers of change and are intended to help:

- Understand interactions between the trends and other features observed in the discrete dimensions of DCDC's **Strategic Trends**.

- Distinguish between the long-term significant changes and short-term turbulence.

- Identify major challenges and opportunities in the future strategic context.

Expressing Probability

All findings within **Strategic Trends** are presented with an indication of confidence, using the expressions of probability listed below. These are emboldened in italics within the text. Owing to the high number of variables, not least the operation of chance and the intervention of human beings, trends-based analysis can never offer precise predictive analysis and these terms provide an indication of confidence based on the available evidence and an assessment of risk.

Assessment of Probability		
Description	**Probability %**	**Confidence Level**
Will	>95%	Near Certainty
Likely/Probably	>60%	High
May/Possibly	>10%	Low-Medium
Unlikely/Improbable	<10%	Low

Sources

The need for rigour and objectivity means that wide external consultation and review are required if **Strategic Trends** is to be both **comprehensive** and **independent** in its view of the future. The Team have therefore exploited a wide range of sources and experts beyond the UK MOD, in and beyond Government, at home and abroad. The extensive assistance and advice that has been received in developing this edition of **Strategic Trends** has been excellent and individual contributions are acknowledged at Page 90.

It is also important to avoid analysing trends solely from a Western standpoint. The Team therefore, tested their findings against the views of an international, and largely non-Western, peer group. This was achieved by exposure of the ideas in conferences and commissioning a survey through **LEAD International**, a non-profit organisation with a global network of opinion-formers and leaders in business, government, the media, NGOs and the academic sector. The results of this survey can be found on page 86.

Strategic Trends: Key Findings

"The benefit of strategic futures work is not that it predicts the future, which is unpredictable, or enables organizations to control it. It is about rehearsing possibilities, so one is better able to respond if they happen"[1]

Introduction

A defining feature during the next 30 years will be the constant tension between greater interdependence and intensifying competition. This feature will stimulate competing strategies based around the extent to which individuals and communities wish to exploit change, or resist it.

During the next 30 years, every aspect of human life *will* change at an unprecedented rate, throwing up new features, challenges and opportunities. Three areas of change, or *Ring Road* issues, *will* touch the lives of everyone on the planet and *will* underpin these processes: climate change, globalization and global inequality (see panels below). Progressive climate change *will* shape the physical environment within which a rapidly expanding world population will live, influencing variable access to habitable land, food and water. The volume of the world economy *will* grow more quickly than at any time in human history and, in socio-economic terms, *will* become more tightly integrated, creating globalized interdependencies and enabling multiple supra-national linkages in all areas of human endeavour.

While life for most people is *likely* to improve materially, a significant number *will* continue to experience hardship, and unevenness and fluctuations within a globalized market-based economy *will* still mean that life *will* be uncertain for most. In all but the most affluent societies, rapid, large shifts in global markets, which are increasingly sensitive to uneven supply and changing demand, *will* result in potentially dramatic changes in personal fortune and confidence. Globalized communications *will* feed aspirations, heighten expectations and *will* serve to expose differences in advantage and opportunity, stimulating grievance and raising the significance of global inequality as a social and political issue.

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[1] Benchmarking UK Strategic Futures Work – Government Performance and Innovation Unit.

Climate Change

There is compelling evidence to indicate that climate change is occurring and that the atmosphere **will** continue to warm at an unprecedented rate throughout the 21st Century. A scientific consensus holds that a large part of this warming is attributable to human activities, primarily through the concentration of CO_2 and other greenhouse gases. Change **will** be intensified and accelerated by the diminution of natural carbon-capture processes (such as forests and marine life) and the reduction of the polar ice-caps. Uncertainty remains as to the precise rate and character of expected changes over the next century. Climate science is complex, with linear cause and effect relationships not yet readily apparent; therefore, the consequences of climate change **will** vary in their impact in time, incidence and geographical extent. It **may** be a very unstable and unpredictable process, involving both progressive evolution and sudden instabilities. Major consequences are **likely** to include melting ice-caps, thermal expansion of the oceans, and changes to ocean currents and flows, with seawater becoming more acidic as CO_2 transfers from the atmosphere. On land, some regions **will** experience desertification, others **will** experience permanent inundation, and tundra and permafrost are **likely** to melt and release methane, **possibly** in large amounts. Global climate change **will** reduce land for habitation and **will** result in changing patterns of agriculture and fertility, while tropical diseases, like malaria, are also **likely** to move North and into temperate zones. There **will** be an increased risk of extreme weather events, threatening densely populated littoral, urban and farming regions with eccentric growing seasons, flooding and storm damage. Climate change **will** remain highly politicized: although the relationship between causes and effects is **likely** to be increasingly understood as more evidence and computing power becomes available, responses **will** be contested and affected by self-interest.

**The melting rate of the Perito Moreno Glacier in Argentina has doubled in recent years.
Picture Taken 16th October 2003 - Source: Empics.com**

Globalization

During the next 30 years, the volume of transactions, conducted irrespective of the physical distance between those engaged, *will* continue to expand, shaping and improving everyday life for millions of people. A key feature of globalization *will* be the continuing internationalization of markets for goods, services and labour, which *will* integrate geographically dispersed sets of customers and suppliers. This *will* be an engine for accelerating economic growth, but *will* also be a source of risk, as local markets become increasingly exposed to destabilizing fluctuations in the wider global economy. These outcomes *will* be facilitated by the rapid development of global telecommunications resulting in a pervasive information environment in which much of the global population will be 'online all the time'. Also, there *will* continue to be winners and losers in a global economy led by market forces, especially so in the field of labour, which *will* be subject to particularly ruthless laws of supply and demand. Life *will*, as a result, be competitive, dynamic and fluid. Socially, looser forms of political, cultural and economic association *will* multiply, whose existence *will* be largely virtual and disassociated, linking members who are physically dispersed, but who share common interests and seek competitive advantage by association. Politically, globalization *will* raise levels of interdependence between states that are increasingly integrated within the globalized economy.

Global Inequality

While material conditions for most people are *likely* to improve over the next 30 years, the gap between rich and poor will *probably* increase and absolute poverty *will* remain a global challenge. Despite their rapid growth, significant per capita disparities *will* exist in countries such as China and India and smaller, but traditionally more affluent Western economies. In some regions - notably areas of Sub-Saharan Africa – a fall in poverty *may* be reversed. Differentials in material well-being *will* be more explicit through globalization and increased access to more readily and cheaply available telecommunications. Disparities in wealth and advantage *will* therefore become more obvious, with their associated grievances and resentments, even among the growing numbers of people who are *likely* to be materially more prosperous than their parents and grandparents. Absolute poverty and comparative disadvantage *will* fuel perceptions of injustice among those whose expectations are not met, increasing tension and instability, both within and between societies and resulting in expressions of violence such as disorder, criminality, terrorism and insurgency. They *may* also lead to the resurgence of not only anti-capitalist ideologies, *possibly* linked to religious, anarchist or nihilist movements, but also to populism and the revival of Marxism.

Owing to this increased interdependence and intensifying competition, most states **will** be bound together by their economic linkages, but **will** nonetheless be preoccupied by the need to sustain national economic vitality and political advantage. Individual well-being **will** depend increasingly on access to, and exploitation of, opportunity within the globalized economy, but most people **will** nonetheless regard the operation of globalized processes as, in many ways, threatening. This is **likely** to result in local arrangements to mitigate the harsher effects of globalization and the rigorous operation of the market on some countries or communities, in the interests of socio-economic stability or competitive advantage.

This tension **will** heighten preoccupation with risk at every level, from the personal to the international. Contrasting approaches and pragmatic solutions for dealing with risk **will** emerge, the nature of which **will** depend on the extent to which individuals and communities wish to promote and exploit change, or resist and even reverse it. These strategies **may** be cooperative, obstructive, competitive, or even distinctly predatory – or a combination of them all over time. The major factors that **will** influence which approach is adopted and the ways in which strategies are **likely** to be shaped are discussed in ***4 Key Themes of: Population and Resources, Interest and Identity, Governance and Order, and Knowledge and Innovation.***
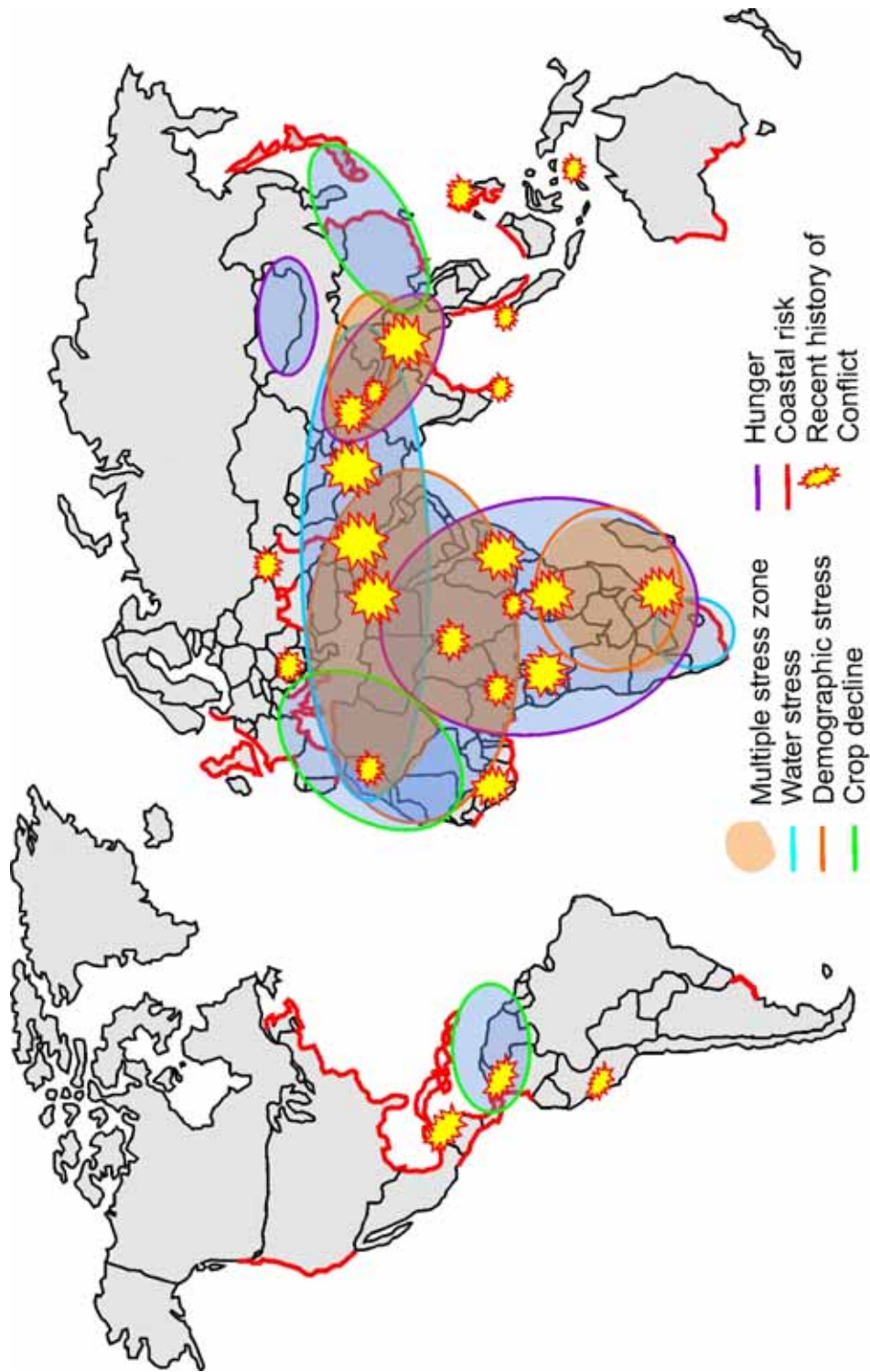
Figure 2 – Multiple Stress Zones: Instability is *likely* to be greatest in areas of Multiple Environmental Stress

Key Theme 1 - Population & Resources

Sustained population growth, aggressive economic competition and increased consumption, together with rapid modernization and urbanization, *will* result in intensive exploitation and pressure on resources of all kinds. These tendencies *will* be aggravated by the consequences of climate change, environmental changes and an increased human footprint. Consequently, the availability and flow of energy, food and water *will* be critical issues, with the potential for fluctuations and imbalances in both production and distribution, at global, regional and local levels. Resource challenges *will* intensify in those areas already badly affected, typically in low and lower-middle income regions where population expansion has the greatest impact relative to local resources and economic growth.

The expansion of global media and Information Communications Technology (ICT) *will* heighten the sense of grievance and marginalization between 'haves and have-nots', nationally and internationally. This is *likely* to lead to populism, human crises and confrontations, typified by inter-communal and inter-ethnic conflicts at local level, but, when related to access to strategic resources necessary to sustain developed or developing economies, *may* increase the incidence and risk of international confrontation. Communicable disease *will* continue to be a feature of human life; while familiar diseases *will* be eradicated or mitigated through prophylaxis or cure, others *will* emerge, of varying intensity and impact, alongside the constant risk of low incidence, but potentially high impact, pandemics.

Population & Resources - Potential Implications

- Competition for resources of all kinds *will* intensify. Developed and developing economies *will* seek political and economic partnerships with states to guarantee supply. Moral compromises *may* be made in relation to some regimes.

- There *will* be an increased risk of humanitarian catastrophe in the most vulnerable regions, caused by a mixture of climate change, resource pressures, uneven distribution of wealth, the effect of disease and the failure of authorities to cope with population growth and urbanization.

- Migration and urbanization, within countries and across regions, *will* increase pressure on infrastructure and governance and *may* destabilize existing communities.

- Authorities *will* be challenged by changing demographics, in particular the impact of an increasing youth population in some developing regions and countries - poor employment prospects and unfulfilled expectations *may* lead to vulnerability to populist and other extreme messages.

- Sustained economic growth in developing countries is *likely* to compel societies to re-evaluate the role of women, who *will* play an increasing role in generating wealth.

Drivers of Change

- Economic Growth. The global economy is **likely** to continue to grow at 2-3%[2] per annum out to at least 2020, accompanied by general improvements in material well-being, with more dramatic growth in the Asia-Pacific Region. However, growth **will** be uneven, fluctuating over time and between regions, with Sub-Saharan Africa **likely** to lag behind other regions because of environmental, political and demographic challenges, linked to endemic corruption.

- Population Growth. The global population is **likely** to grow from 6.5bn to 8.5bn by 2035.[3] The greatest growth **will** take place in regions **likely** to face continuing material and economic risks. For example, the population of Sub-Saharan Africa is **likely** to grow by 81% to over 1.3bn by 2035, 15% of which is **likely** to be under-nourished.[4] With more widespread availability of birth-control measures and improved life expectancy, economic status and aspiration **may** increasingly govern birth rates. However, cultural *mores* in some countries **will** persist, maintaining high levels of reproduction.

- Resource Competition. Economic growth and increased consumption **will** result in greater demand and competition for essential resources. Demand for energy is **likely** to grow by more than half again by 2035 and fossil fuels **will** have to meet more than 80% of this increase.[5] Major reserves are in politically unstable regions and primary consumer nations are **likely** to be increasingly reluctant to trust security of supply to market forces and the integrity of the international system.

- Diseases.   Several communicable diseases **will** continue to have a significant impact on population and development and, without effective control measures, **may** spread from developing regions to more settled and affluent areas. Some diseases **will** re-emerge in strength, like tuberculosis, malaria and cholera, as environmental changes occur and the pattern of human activity becomes more diverse and complex. HIV/AIDS **will** remain prevalent in Sub-Saharan Africa, Asia and Eastern Europe and, although a cure and/or vaccination is **likely** before 2035, its impact **will** be long-lasting. The social, economic and human costs of contagious and communicable diseases **will** remain high and are **likely** to slow economic growth drastically in the worst affected regions for at least the first half of the period.

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[2] World Bank: Long Term Economic Prospects: www.worldbank.org downloaded 28 Feb 06.

[3] World Population Prospects: the 2004 Revision Population Database, UN Press Release, 5 Sep 06, on line www.un.org/News/Press/docs/2005/pop918.doc.htm.

[4] The State of food Insecurity in the World 2005, Food and Agriculture Organisation, UN, on line http:www.fao.org//docrep/fao/008/a0200e/a0200e.pdf

[5] International Energy Agency: World Energy Outlook 2005.

- Changing Demographics.   The balance between economically inactive and active members of society *will* alter significantly and there *will* be sharp age differentials between the ageing First World and the youthful Third World. Overall, the global population is ageing and cyclical unemployment *will* become more widespread, especially among the growing urban poor, who are *likely* to make up 25%[6] of the global population. Marked age imbalances, between regions and countries, together with gender imbalances, *will* accentuate and exacerbate existing tensions, both regionally and internationally. These trends *will* be partially off-set by increased immigration to the First World, but will be accompanied by demographic pressure and containment issues.

- Environmental Impacts.   By the end of the period, nearly two-thirds of the world's population *will* live in areas of water stress,[7] while environmental degradation, the intensification of agriculture, and pace of urbanization *may* reduce the fertility of, and access to, arable land. There *will* be a constant heavy pressure on fish stocks, which are *likely* to require careful husbanding if major species are not to become depleted or extinct. Food and water insecurity *will* drive mass migration from some worst affected areas and the effects *may* be felt in more affluent regions through distribution problems, specialized agriculture and aggressive food-pricing.

- Mass Displacement.   Conflict and crises *will* continue to trigger the displacement of large numbers of people, mainly into proximate regions, which *may* find themselves at risk of instability or exogenous shock.

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[6] UN-HABITAT (2003) Slums of the World -The Face of Urban poverty in the New Millennium. United Nations Human Settlements Programme, Nairobi.

[7] UN EP: http://www.unep.org/vitalwater/21.htm#21b published 2002.

Urbanization – The Favela Morumbi, Sao Paulo, Brazil 17 January 2004 - Source: Empics.com

- Urbanization & Human Settlement.   By 2035, 60% of the world's population *will* live in urban areas.[8] There *will* be a substantial growth in shanty towns and unplanned, random urban settlement, increasing the resource cost and environmental impact. In some cases, rapid, uncontrolled development *will* challenge the ability of growing cities' infrastructure and governance to control and support the additional settlement and some cities *may* not cope. Similarly, populations *will* increasingly inhabit areas which defy nature and *will* be at significant environmental risk. This is particularly true in areas susceptible to volcanic and seismic activity and in low-lying coastal regions where extreme weather events and inundation are *likely* to occur with increasing frequency. This *will* result in an increase in humanitarian crises and a significant rise in mass migration.

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[8] Urban Population Trends 26 Jan 05, peopleandplanet.net online at http://www.peopleandplanet.net/doc.php?id=1489

Key Theme 2 - Identity & Interest

Globalized communications *will* provide groups and individuals with greater visibility of the advantages and disadvantages of others and also the additional means by which they can exploit opportunities and pursue their own advantage and interests. Physical separation *will* decline in significance in the pursuit of interests, but personal and collective physical security *will* remain crucial to any substantial, successful enterprise, except in those areas of opportunity where the long-term gains can reasonably be balanced with the immediate, moderate risk. The extent to which individual identities are fixed *will* vary, becoming more complex as people move between contexts and associations in pursuit of opportunity and fulfilment. People *will* continue to draw on their personal and cultural origins, but *will* acquire features from adoptive cultural, commercial or physical surroundings to construct their personal narratives and identities. Collective identities *will* develop to accommodate greater diversity of origin and culture where this brings advantage to the community as a whole, while becoming more exclusive where it does not. Nationhood and ethnicity, especially in ethnically homogenous and ideologically nationalistic states and communities, *will* continue to exert a powerful emotional influence. Migration and more fluid movement of people across borders *will* result in the growth of diaspora and expatriate communities, creating clearly defined enclaves with extensive, persistent links to countries of origin.

Identity & Interest - Potential Implications

- While citizenship and physical security *will* remain important, individual loyalty to the state and state institutions *will* become increasingly conditional, based on personal identity and interest.

- Nationhood and ethnicity in certain countries *will* continue to influence human behaviour and international relations.

- Diaspora communities and their networks *will* be dynamic and unpredictable features of the political, demographic and economic aspects of globalization.

- Physical and cultural origin *will* continue to be significant to identity, but *will* be employed increasingly selectively, based on their utility in context and in relation to personal interest.

- Communities *will* increasingly form around the pursuit of common interests, and *may* dissolve rapidly when they are no longer relevant.

Drivers of Change

- **Access to Information.** The pervasiveness of ICT **will** enable more people to access and exploit increasingly interconnected and sophisticated information systems. For example, it is estimated that 20% of the African population **will** subscribe to internet-enabled mobile phones by 2010.[9] The Internet and associated technologies, together with digitized portable communications, **will** increasingly become the means by which a rapidly expanding array of audio, visual and written information and entertainment products is distributed.

- **Communitarianism.** Population growth, especially its concentration in larger urban settlements (for example, those with more than 500k inhabitants), and more informal, adaptive ways of working **will** challenge and strain the capacity of governments to provide adequate, responsive infrastructure, utility provision and social services, as well as institutional and personal security. This **may** lead to a decline in civic support systems and increased reliance on local communities, extended family networks and personal patronage.

- **Migration.** Migration **will** increase in response to environmental pressures, deprivation and the perception of economic opportunities offered in towns and cities, as well as in wealthier regions and countries. Some 175m people, 3% of the world's population, currently live outside their country of origin. That number is **likely** to grow to 230m by 2050.[10]

- **Dynamic Diaspora.** ICT developments and advanced mass-transit systems **will** facilitate and increase connectivity between ethnic/national diasporae and their communities of origin. This **will** tend to reduce incentives for integration and assimilation and allow self-contained 'virtual' communities to exist across continents in ways not always in step with the interest and aspirations of their host countries. Remittances from members of diasporae **will** remain an important source of capital transfer and redistribution, especially for developing countries. Less benignly, diaspora **will** remain a medium for the international transmission of social risk, including: inter-communal violence, terrorism and transnational crime, especially trafficking and illicit trade.

- **Growing Cultural Complexity.** Increasing numbers of people **will** become accustomed to dealing with cultural complexity and mobility. The movement of people in pursuit of economic opportunity and a secure environment **will** create more cosmopolitan population centres, while English is **likely** to consolidate its position as the internationally dominant language for data and global services,

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[9] A mobile vision for Africa, 6 Jul 04, on line http://www.textually.org/textually/archives/2004/07/004433.htm
[10] UN Department of Economic and Social Affairs/Population Division. International Migration Report 2002 (New York, 2002).

supplementary transnational languages, such as Mandarin, Spanish and Arabic, *may* proliferate as engagement in globalized communication increases. Sophisticated translation devices are *likely* to become widely available during the period under review.

Growing Cultural Complexity – McDonald's restaurant in Riyadh, Saudi Arabia. Picture taken 12th October 2004 - Source: Empics.com

- Changing Values.   Secularism and materialism are *likely* to grow in significance in an increasingly competitive, inter-connected world, reflecting trends that are already well established in the more developed regions. Meanwhile, cultural mixing, the pace of change and a rapid confluence of modern ideas and traditional values are *likely* to increase the trend towards moral relativism and increasingly pragmatic values. These developments *will* trigger responses from complex, traditionally defined communities, as well as among significant minorities, which *will* seek the sanctuary provided by more rigid belief systems, including religious orthodoxy and doctrinaire political ideologies, such as popularism and Marxism.

- Material Expectations. The Western, capitalist model *will* continue as the economic paradigm and dominant cultural model for the aspirations of most of the world's population, with individuals seeking to match the lifestyle of their Western counterparts. Expectations, fuelled by increasingly globalized communications, media access and the promise of progress, *will* be further heightened by overall economic growth, which *will* be extremely rapid in some regions, and by continuing high standards of living in the more affluent ones. Visible marginalization, differential levels of poverty and affluence and a sense of grievance *will* increase in significance and become major political issues, based around transnational moral justice agendas, including violent activism of varying intensity and impact.

2035: Identity Issues

2005: Cultural Categories

Super Diversity
Governance
Cultural Complexity
Globalised Communications
Conditional Loyalty

Changing Values
Context - based Identity
Interest - based Communities
Expectations
Migration

12,600 constituent peoples
5 Major "Races"
13 Geographical "Races"
432 major peoples

7 Continents
71 ethno-linguistic families
191 Countries
13,511 living languages
10,000 religions

An individual's related but distinct characteristics - race, colour, ethnic origin, nationality, culture, language
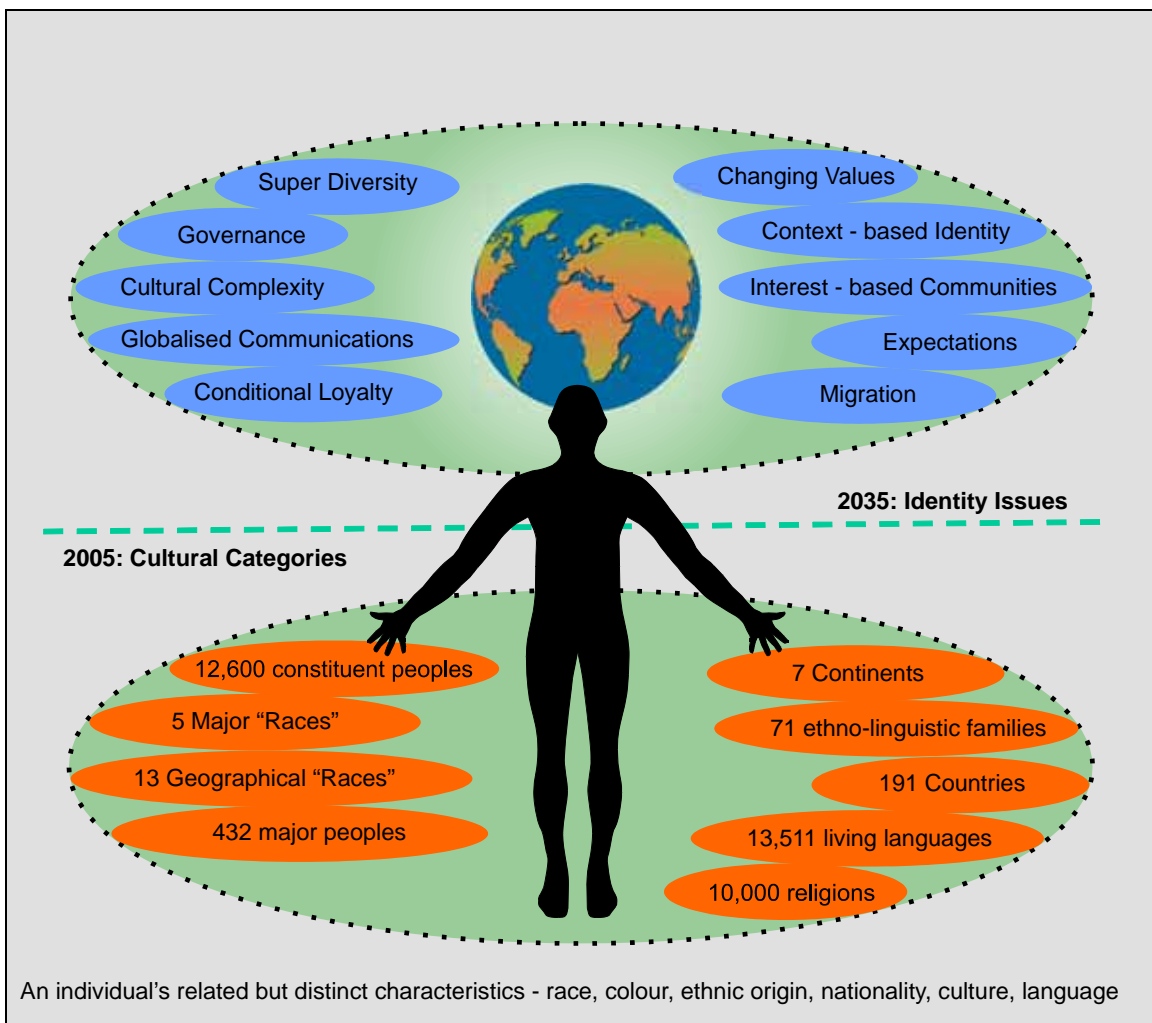
Figure 3 - Culture and Identity: Increasingly, identity will be anchored less to fixed cultural categories, shifting instead according to context and interest.

Key Theme 3 - Governance & Order

States and Communities **will** be progressively challenged by the range and complexity of the national and transnational risks that are beginning to dominate the 21ˢᵗ century - and some **will** not cope. Owing to world-wide communications, the pervasive scrutiny of the media and the inter-connected nature of international engagement, challenges to stability, security and political order **will** increasingly have local, regional and global consequences. Therefore, there **will** be a growing understanding of the limits to which solely locally-derived solutions are able to contain, and deal with, these challenges. Governments **will** increasingly seek international and cooperative solutions to safeguard national interests. Typically, those which share common interests **will** increasingly collaborate to contain the symptoms of crises, while developing new institutional mechanisms to mitigate, control or deal with their causes. However, some regimes **may** take whatever action they believe necessary to prevail or survive, maintain control or perpetuate a way of life, especially in the face of catastrophic or abrupt change. Also, the transition from a unipolar to multipolar world **will** be uneven, with varying and volatile degrees of competition and collaboration. Consequently, tensions **will** continue between the desire to establish collective solutions and the limitations on the independent operation of national sovereignty required for them to work.

Governance & Order - Potential Implications

- Transnational pressures, competition and globalization **will** challenge the robustness and resilience of governance and social mechanisms at every level.

- New collaborative institutions, philosophies and mechanisms **will** be required to cope with complex, inter-connected global and regional problems.

- The exercise of national sovereignty **will** increasingly be expressed in support of collective international action, but regimes and polities **will** continue to act to protect their citizens and sustain their vital interests and stability.

- Responsibility for international arrangements **will** lie with the national parties to them; the emergence of a new supra-national sovereign power is **unlikely**.

- Gaps and strains in the increasingly complex patchwork of arrangements for international governance **will** be open to exploitation and abuse.

Drivers of Change

- **Globalized Economy.**   Globalization *will* remain a significant feature of long-term economic change, with higher proportional growth in foreign direct investment levels and international trade than in global output. This *will* increase interdependency, while exposing local markets to externally-derived risk. This tendency *will*, when it threatens social or regime stability, lead to unilateral tariff and protectionist action and preferential bilateral arrangements based on mutual self-interest or political advantage. Owing to varying degrees of regulation and corruption in the globalized economy, trafficking, institutionalized criminality and illicit trade *will* remain major features of the landscape.

- **US Transition.**   As the world's pre-eminent economic and military power, the US is the primary architect and main guarantor of an international rules-based system, as well as a force of last resort. The status, culture and intentions of the US *will* have a decisive effect on the evolution or survival of that system, as it adjusts in reaction to an uneven, possibly unbalanced transition from a unipolar to a progressively multipolar world. In doing so, the US *will* have to respond to, among other things, the rising economic challenge of Asia, more competitive commodity and energy access, and price and supply fluctuations, as well as dealing with internal demographic, debt and social pressures. Anti-Americanism *will* continue to be used as a convenient vehicle for the expression of grievance and resentment arising from a wide range of issues, well beyond the point at which other rising powers emerge.

- **Chinese Economic Development.**   China *will* be one of the most significant factors in the future of the globalized economy as its position as the 'workshop of the world' *will* have decisive influence on global economic demand and labour markets. At the same time, its ever increasing foreign exchange reserves reflect growing Western indebtedness. China's future political direction *will* be crucial therefore, not only for its own economic expansion, prosperity and stability, but for that of the whole world. However, that political direction *will* be conducted against a range of significant challenges; environmental, social, political, financial and demographic. Failure to address these successfully *may* result in economic failure, political instability, societal disorder and unrest, with both regional and global repercussions. Chinese success in sustaining hitherto rapid economic growth allied with social and environmental reform, *may* result in a challenge to the U.S status as the global hegemony in the second half of the twenty first century.

- **International Crime & Illicit Trade.**   International organized crime *will* grow in volume, reach and profitability, while exploiting new ventures and markets in areas of accelerating economic growth and opportunity, particularly in Asia and in

developing transnational markets. The annual global market for illicit drugs in 2005 was estimated at $322bn[11] and was higher in retail price than the GDP of 88% of the countries in the world (163 out of 184 for which the World Bank held data).[12]   Many states **will** continue to rely on narcotics and other forms of illicit trading to maintain liquidity in their economies; aggressive exploitation of the weaknesses exposed by globalization to promote illicit trade and encourage corruption **will** present a major challenge to governance, to fiduciary arrangements and international financial regulation. However, the trade in narcotics **may** decline in response to a combination of over-supply, legalization and increasing intolerance of the social impact and cost in the developed world.

- Transnational Terrorism.   Transnational and locally based terrorism, particularly Islamist, **will** continue to derive its energy and justification from political motivations, disadvantage and grievance, extending beyond poorer and more volatile regions to include the marginalized in middle-income and more affluent societies. The casualties and amount of damage inflicted **will** remain low, compared to other forms of coercion and conflict, but the effect **will** be magnified by reach (both physical and psychological), the scale of disruption to infrastructures and the sensationalist value inherent in the 'Theatre of Violence' and the 'Propaganda of the Deed'. Based on technological availability and historic examples, chemical, biological and radiological elements **will** be viable and credible possibilities for terrorist attack throughout the period, together with a lower possibility of nuclear use.

- Ungoverned Spaces.   Some geographical areas, including failed states, provinces or cities, and other population groupings, **will** not be subject to effective governance and the rule of law. Some weak states, while continuing to claim rights of sovereignty, **will** subsist through illicit trade and institutionalized criminal activity, while others **will** be ineffective in curbing instability and containing the consequences of transnational pressures. The risks associated with these ungoverned and poorly governed spaces, including endemic criminal activity, the basing of terrorists, irregular activity and conflict, are **likely** to increase and add to the complexity, and, by extension, to the burdens of maintaining the integrity of the international system.

- Gender Equality.   The significance of the divide between societies that are progressing towards, or **will** have achieved, greater gender equality and those that are not **will** continue to grow. This issue is **likely** to remain a defining cultural and social theme during the 21st Century, influencing the conduct of international political, economic and cultural relationships, but its progress **will** be uneven and

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[11] United Nations Office on Drugs and Crime Annual Report 2005 page 4.

[12] www.drugwarfacts.org/economi.htm.

will be conditioned by cultural assumptions, demographic trends and economic circumstances.

- Chemical, Biological, Radiological and Nuclear Weapon Proliferation.   Access to technology that enables the production and distribution of Chemical, Biological, Radiological and Nuclear (CBRN) weapons is *likely* to increase. A critical indicator of risk is contained in the examples of North Korea and Iran - both in obtaining or seeking nuclear weapons and in exploiting their putative possession for political and economic advantage. In future, much proliferation and threat *will* be manifest in the ungoverned space between legality and *realpolitik*, together with the distinct possibility of the acquisition of CBRN material by non-state and rogue elements.

- Technological Development.   Innovation, research and development *will* originate from more international and diffuse sources and *will* proliferate widely, making regulation and control of novel technologies more challenging. The exploitation of these *may* have catastrophic results, especially those associated with nanotechnology, biotechnology and weapon systems. These *may* be unintended, for example 'runaway' nanotechnology or biotechnology, or intended, such as the development and use of directed energy or electromagnetic-pulse weapons.

Humanitarian Crises - Mother with Undernourished Children at Harar, Ethiopia May 2006 - Source: Empics.com

- Humanitarian Crises.   Humanitarian crises, both natural and human in origin, *will* affect the sentiments and sensibilities of globalized media audiences. Growing pressure for intervention *will* be exerted by these audiences and a hyperactive,

obtrusive media, operating in both physical and virtual dimensions, especially when audiences are linked to those affected by identity or interest, or where they feel threatened by potentially wider or collateral impacts. Humanitarian fatigue *may* grow in proportion to the number of crises that emerge and the ability of governments and individuals to pay.

Key Theme 4 - Knowledge & Innovation

Technological development *will* continue to be predominantly commercially-led, driving innovators and entrepreneurs to identify and produce as many applications of new technologies as possible, although certain sensitive, niche, high cost/high impact programmes *will* continue to be conducted by military or governmental agency. There *will* also be extensive proliferation of access to technological and specialist information by a wider range of audiences and users, and even maintaining secrecy about sensitive technologies and systems *will* be extremely difficult. Innovation is *likely* to continue at an unprecedented rate and there is *likely* to be a multiplicity of sources of innovation and production. Making predictions about how novel and emerging technologies would be exploited and applied *will* be difficult and imprecise. The rate of change, tempo and unpredictability of innovation and development *will* challenge decision-makers who *will* have to anticipate and respond to direct and indirect outcomes. Notwithstanding this, trends indicate that the most rapid technological advances are *likely* in: ICT, energy, biotechnology, cognitive science, sensors and networks and smart materials. Nanotechnology is *likely* to be an important enabler for other developments, for example in electronics, sensors and commodity manufacture.

Whilst technology *will* benefit many people, its application and integration *will* continue to be unequal, reinforcing differences in understanding, advantage and opportunity between the haves and have-nots.

Knowledge & Innovation - Potential Implications

- The volume of information *will* challenge decision-support processes which are based on 'ordered' knowledge management and rigid hierarchical organizations.
- Technology-watch processes and intelligence agencies *will* be challenged by the speed and diversity of innovations, which are *likely* to 'pop-up' with increased frequency.
- The rate of technological innovation *will* reduce the time available for its 'cultural' assimilation and control, increasing the likelihood of unintended outcomes.
- It is *possible* that significant developments in quantum computing could lead to the compromise of some digital cryptology, with resulting implications for commercial and military use.
- More effort *will* be required in technical intelligence to provide early warning of unilateral or unexpected technical advantage.

Drivers of Change

- **Commercial Imperative.**   Global economic growth, resource pressure and increasing socio-economic dependency ratios **will** fuel demands and create opportunities for innovation and investment. Development is increasingly **likely** to be directed towards commercial imperatives (business enterprises accounted for 68% of OECD Research and Development (R&D) expenditure in 2003).[13] This aspect **will** drive innovators to identify as many applications and markets for their discoveries as possible, with interdisciplinary[14] R&D **likely** to lead to the most revolutionary outcomes. This aspect **will** make the implications and impacts of breakthroughs difficult to predict.

- **New Innovation Centres.**   Increasing volumes of R&D **will** take place outside traditional lead regions, with rapid proliferation and expansion of information and research facilities into rising powers and developing regions. This is **likely** to lead to a decline and even reversal in the technological dominance of the West with China and India poised to become technology leaders[15] in some areas. Non-OECD countries increased their global share of R&D from 17% to 20% between 2001 and 2003 alone.[16] China is now the third largest investor in R&D, over 60% of which is conducted by business enterprises, and other countries such as Brazil, South Korea, Taiwan and Israel are developing world class capabilities in interdisciplinary areas. Intellectual property and commercial exclusivity are **likely** to be under constant pressure from inadvertent disclosure, penetration and espionage.

- **Labour Mobility.**   Highly capable and skilled individuals, including those employed in R&D, but particularly those with commercially profitable or politically useful skills in niche or scarce areas, **will** attract substantial rewards for their services and **will** be increasingly mobile within the global knowledge-economy market. Over half of the nearly 16m highly skilled expatriate workers in the 4 main destinations (US, Europe, Canada and Australia) have originated from outside the OECD area.[17] This largely one-way traffic **will** become more complex through the period and **will** be driven by the growth of research and entrepreneurial opportunities in emerging nations, easier migration and **likely** changes in traditional career models in business and academia **possibly** resulting in 'Brain circulation' rather than a 'Brain drain'. As emerging powers continue to rise and opportunities and safeguards

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[13] OECD Science, Technology and Industry Scoreboard 2005 – Towards a knowledge-based economy.

[14] The term 'Interdisciplinary' is used to mean a culture that reflects science and technology as a continuum and not a series of discreet areas (physics, chemistry and biology) bounded, primarily, for the sake of education.

[15] US National Intelligence Council – 'Mapping the Global Future' Dec 04.

[16] OECD Science, Technology and Industry Scoreboard 2005 – Towards a knowledge-based economy.

[17] OECD Science, Technology and Industry Scoreboard 2005 – Towards a knowledge-based economy.

become more predictable, a reverse flow to countries of origin is likely to accelerate.

• Growth of Knowledge Sharing.   Transnational knowledge sharing and innovation **will** continue to expand, as indicated by increasing international collaboration in industrial R&D (30% in the UK alone), the increased number of non-native research students (in the US approximately 32% are from Asia)[18] and the growth of internationally owned patents (two thirds of the Russian Federation's European Patent Organization (EPO) patents are owned or co-owned by foreign residents).[19]

• ICT Growth and Pervasiveness.   Another powerful driver for the rate and range of innovation **will** be the continuing increase in the pervasiveness and processing power of ICT. Wearable and implanted wireless ICT is **likely** to be accessible to all that can afford it in the second half of the period, and users **will** be linked through sensors and networks that are enabled by computers that are significantly more capable than at present, **possibly** by 100bn times if quantum computing reaches its potential.[20]

• Demand for New Energy Sources. The potential limits of hydrocarbon resources and the need to reduce carbon emissions **will** stimulate intensive research to find alternative forms of energy. These **will** include, but not be limited to, manufactured or renewable fuel sources such as biofuels and hydrogen, and possibly nuclear fusion later in the period.

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[18] *Ibid.*

[19] OECD Science, Technology and Industry Scoreboard 2005 – Executive Summary.

[20] Peter Cochrane, 'Uncommon Sense: Out of the box thinking for an in the box world', Capstone, 2004.

**Extreme Environments – The Val Gamburtseva Oil Field in Russia's Arctic North
April 4th 2006 - Source: Empics.com**

- Exploitation of Extreme Environments.   The search for alternative energy sources *will* become more urgent at a time when technology *will* permit cheaper more commercially viable space and intro-atmospheric applications. As a result, there is *likely* to be an increase in space exploration and the exploration of other extreme environments, such as polar regions, the deep ocean and deep underground, *will* also increase. As the NASA programme through the 1960s and 70s demonstrated, the exploration of more remote and hostile environments is *likely* to stimulate and deliver extensive technological innovation.

- Advances in Simulation.   Advances in social science, behavioural science and mathematical modelling *will* combine, leading to more informed decision making. Advanced processing and computational power *will* permit a new level of pattern recognition (Combinatronics) enabling the decoding of previously unrecognised or undecipherable systems and allowing the modelling of a range of biological to social, political and economic processes. As a result, simulation and representatives *will* have a significant and widespread impact on the future and *will* become an increasingly powerful tool to aid policy and decision makers.[21] It will also blur the line between illusion and reality.

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[21] Dr Harry Woodroof, Horizon Scanning Centre, Office of Science and Technology.

Strategic Trends: Dimensions

Introduction

This section outlines the initial findings in each of the *5 Strategic Trends Dimensions*, which have been used to develop the *Key Themes* above. In each case, an outline of the analytical *Scope* of the dimension is followed by discussion of the most probable *Outcomes*, significant attendant global *Risks* and selected *Defence and Security Implications*. Finally, the potential for variation from our assessment of the most likely outcomes is outlined for each dimension *('Potential Trend Variation').* The possibility for major discontinuities, or *Strategic Shocks*, which will change global outcomes in more radical ways, is considered in a final section.

Resource Dimension

Scope

For most of its history, humankind has striven to secure basic physical needs, avoid disease and improve living standards and prospects. During the last century, unprecedented numbers of people have been living in conditions of increasing affluence and most of those who do not aspire to do so. The *Resource Dimension* considers the extent to which the aspiration to achieve increasingly higher standards of living, or sustain existing levels, will be met in the future. In doing so, it considers the physical and environmental challenges that will condition these aspirations, the economic activities through which they will be attempted, and the consequences that might arise.

The *Resource Dimension* analyses trends in:

- Environmental risk, water and food.

- Energy and raw materials.

- Health and disease.

- The built environment.

- The global economic system.

- Growth and development.

The *Hot Topic* in this dimension is the *Competition for Energy Resources*.

Outcomes

Over the next 30 years, the resource-related challenges to global stability *will* be diverse, wide-ranging and significant. Climate change and a shifting environment; increasing demand for natural resources, particularly food, water and fossil fuels; a growing and rapidly globalizing economy; urbanization and the emergence of new health challenges *will* all have major impacts and unpredictable effects. While the global economy is *likely* to grow during the period, improving material conditions for many people, the combined, uneven effect of these impacts *will* be to increase uncertainty for many, creating new sources of insecurity, instability and tension.

Climate Change – Dry Reservoir Bed, Valencia, Spain – 8th September 2006 - Source: Empics.com

Climate change *will* occur, although, as a result of many variables and limitations in current computing power, assessments of its exact causes and course *may* remain unclear for some time. The identification of precise cause-and-effect mechanisms *will* be difficult to discern, together with the inter-relationship between various contributory factors, complex mechanisms and associated phenomena. As a result, climate change as a whole is *likely* to be variable and uneven in its impact, affecting different parts of the globe in different ways. Although some definite patterns and realignments are *likely* to emerge towards the middle of our period, climate change is *likely* to be difficult to predict at the regional level and some changes *may* be sudden and uneven in their impact.

Major developments **will** include an increase in the frequency and intensity of extreme weather events, changing regional weather patterns, rising sea levels and desertification. Food production, cultivation and animal husbandry patterns **will** be affected and some regions **will** be unable to grow current food staples, such as rice and green vegetables; fish stocks **will** diminish or migrate. Climate change **will** also increase pressure on water supplies and their associated industries and populations; as a result, the number of water stressed regions is **likely** to multiply. The release of a large quantity of methane (from melting tundra or the deep ocean) into the atmosphere is **unlikely**, but would have serious consequences for global warming should it occur.[22]

Predictions of future climate change vary significantly. The last assessment by the Intergovernmental Panel on Climate Change (IPCC) in 2001 suggested a **likely** rise of global average temperature of 0.8 ºC to 1.7 ºC by 2050 and 1.4 ºC to 5.8 ºC by the end of the century. Since then, an emerging body of research suggests that a reduction in the capacity of the biosphere to absorb CO_2 is **likely** to accelerate the CO_2 rise from any emissions scenario, with many uncertainties in the response of temperature to a given CO_2 concentration change. Several more recent studies included in the Stern Report[23] suggest a doubling of pre-industrial levels of CO_2 is **likely** to be reached between 2030 and 2060 and indicate a 20% probability that the associated temperature increase could be greater than 5 ºC. Overall, the upper bound of plausible temperature changes **may** be larger than that suggested in the IPCC report, but it should be noted that the global average figures alone do not fully convey the magnitude and severity of specific impacts in certain regions, particularly those arising from extreme weather events.

Climate models are virtually unanimous in predicting that the land **will** warm faster than the ocean and that higher latitudes **will** experience greater relative warming than low latitudes. Over the next 50 years annual average air temperatures over Europe are **likely** to rise by anything up to 4 ºC depending on individual emission scenarios and climate models. A number of climate models show increased daily variability in summer in Northern Hemisphere land areas; when combined with the underlying increase in average temperature, this **will** lead to extreme high temperatures and sustained heat waves occurring with a frequency not experienced in Europe in modern times. While the North is **likely** to experience a small increase in annual mean precipitation, mainly in winter, the Mediterranean is **likely** to become more arid.

The world's climate is currently projected to transform progressively and largely incrementally over the century, but abrupt climate change has occurred in the past, for example as a result of large volcanic eruptions. Abrupt climate change as a consequence of anthropogenic, external or natural causes, is a **possibility** for the future. Regional earthquakes, major volcanic eruptions in areas of tectonic instability, and Tsunamis

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[22] Methane is 8 times more powerful as a greenhouse gas than CO_2.

[23] The Stern Review on the Economics of Climate Change, Sir Nicholas Stern, HM Treasury, 30 October 2006.

remain an ever-present possibility, their impact enhanced by increased intensity of human occupation, especially in littoral regions.

Despite these natural challenges, the global economy is *likely* to continue growing at about 2-3% per annum until at least 2020, with greatest growth among emerging economies, for example Brazil, China and India, possibly together with Russia and Iran. International trade and finance mechanisms and institutions *will* be forced to reform in response to the rapidly changing global economy. Economic growth *will* lead to a reduction in absolute poverty in most regions of the world, but this growth *will* be uneven and improved access to information is *likely* to stimulate growing concern over comparisons between living standards. Economic growth, combined with the continuing rise in the global population, *will* intensify the demand for natural resources, minerals and energy. Oil is *likely* to remain the principal source of motive power, particularly for vehicles, and growing competition for this diminishing resource *will* lead to a significant rise in energy prices. It is *possible* that this will cause a slow down in economic growth from 2020, although this *may* be offset by new sources of energy: coal derivatives, hydrogen fuel cells, bio-ethanol and for power generation, nuclear fusion. Although finite, reserves of key minerals are *unlikely* to be exhausted in this period, despite sustained increases in demand for metals such as copper. However, a small number of minerals such as tantalum used in portable electronic devices, or cobalt found only in restricted geographic locations, *will* continue to fill niche requirements in manufacturing, and *will* therefore be of disproportionate significance. The need to guarantee supply for economic prosperity *may* lead to upward pressure on prices and a scramble for resources in mineral rich regions such as Africa.

Exploration is also *likely* in more extreme environments such as the deep ocean and *possibly*, later on, in space. For example, the US Geological Survey estimates that around 25% of the remaining global oil and gas reserves are *likely* to be located in the Arctic. Although the harsh climate and environmental restrictions currently militate against oil exploration and production in this region, Arctic warming is *likely* to be double the global average and this *will* significantly improve prospects for future exploitation. Petrochemical companies, aggressively developing new extraction technologies, are *likely* to pursue oil production, undeterred by current environmental limitations, constraints and concerns. The annual reduction in Arctic ice coverage is *likely* to continue, leading to the prospect of a year-round Northern sea route across the Arctic Ocean between continents and *may* culminate in a summer ice-free Arctic in the period 2040 to 2080. These routes *will* become strategically significant, offering shorter and more direct trade links between North America, Europe and Asia.

Processes associated with global economic growth *will* also contribute to societal challenges arising from changing patterns of health and disease, and rapid urbanization. By 2035, most people (60%) *will* be living in urban rather than rural environments. Poor housing, weak infrastructure and social deprivation *will* combine with low municipal

capacity to create a range of new instability risks in areas of rapid urbanization, especially in those urban settlements that contain a high proportion of unplanned and shanty development. Between 10-13m Chinese migrants[24] are **likely** to move to urban areas each year and planned urban construction is equivalent to 'creating a New York City every year for the next 10 years'. However, rapid development has resulted in significant pollution and contamination with an estimated 300-600m people using contaminated water.[25] High volume, mass transport-linked, increasingly urbanized populations **will** heighten the transmission risks of infectious disease to 2035. HIV/AIDS **will** continue to be a major social and economic challenge for Africa and, increasingly, Asia. Despite advances in healthcare, people of many developing countries **will** also be challenged by the illnesses associated with ageing and affluence, such as diabetes, obesity, cancer and cardiovascular disease, even as their dietary and smoking habits change and levels of physical activity reduce. Ageing populations, an increase in medical demand and patient expectations are **likely** to lead to an unsustainable drain on some state health resources and to impact on economic prosperity. Some protection **will** also be required to offset the combined harmful effects of global warming, declining air quality, urban heat islands and overcrowding.

Risks

- Climate Change. The future effects of climate change **will** stem from a more unstable process, involving sudden, and **possibly** in some cases catastrophic changes. It is **possible** that the effects will be felt more rapidly and widely than anticipated, leading, for example, to an unexpected increase in extreme weather events, challenging the collective and individual capacity to respond.

- Energy Market Instability. Overheating of energy markets **may** lead more countries to follow the example of China in establishing bilateral arrangements that seek to dominate or control the global market in their favour, possibly fuelling tension among those who are excluded or who cannot or will not compete in a market environment. This **may** lead to political and even military interventions in order to protect access and safeguard supply. Instability in a supplier region **will** also cause market fragility, including global price spikes, which in the most severe cases **may** trigger wider political instability, especially in economically vulnerable regions. Any major constraints on, or threats to, the free market in energy could arrest or limit the globalization dynamic.

- Food Price Spikes. Increasing demand and climate change are **likely** to place pressure on the supply of key staples, for example, a drastic depletion of fish stocks or a significantly reduced capacity to grow rice in SE Asia or wheat on the

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[24] China International Business Oct 2005 and Guangming Daily reported on July 19 2006.
[25] Beijing AFP 22 Dec 2005 and The Economist 'A Great Wall of Waste' 19 August 2004.

US plains. A succession of poor harvests *may* cause a major price spike, resulting in significant economic and political turbulence, as well as humanitarian crises of significant proportions and frequency. Genetic and scientific modification of food is *likely* to be necessary, both for human and animal consumption and for bio-fuel production.

- Water Scarcity. Water stress *will* increase, with the risk that disputes over water *will* contribute significantly to tensions in already volatile regions, *possibly* triggering military action and population movements. Experience indicates that countries generally seek equitable solutions to water disputes, but that severe shortages *may* provoke more virulent responses. Areas most at risk are in North Africa, the Middle East and Central Asia, including China whose growing problems of water scarcity and contamination *may* lead it to attempt to reroute the waters of rivers flowing into neighbouring India, such as the Brahmaputra. Some severely affected states *may* rationalize water use by importing food rather than pursuing inefficient irrigation projects, while maximizing earnings from low-water input goods and services.

- US Economic Crisis. The US position as the world's most indebted nation makes it vulnerable to stock market collapse, currency runs and economic crisis, as well as global currency manipulation. The most *likely* cause of crisis would be energy market instability or volatility leading to a loss of market confidence. Also, failure to continue to support or service its debt in these circumstances would put US creditors and commodity suppliers at risk, *possibly* causing a global economic downturn.

- Failure of Global Financial System. Economic growth *may* be affected by financial shocks such as economic recession, natural or human-induced disasters or failure to deal with social and environmental challenges. There *will* be further pressure from corruption, organized crime and increasing illicit activity which *will* challenge international regulation, while stressing and undermining trust and fiduciary regimes. A reduction in financial confidence *may* result in states reverting to regional markets and a return to outright state or regional protectionism.

- Disease. Infectious diseases in general *will* continue to have significant economic and social impact across many regions of the world. Beyond Sub-Saharan Africa, emerging economies such as India, China and Russia are *likely* to be challenged significantly by HIV/AIDS, with an estimated 10-20m sufferers in China by 2010.[26] These and other regions *will* be affected by antibiotic resistant strains of other major diseases, like tuberculosis and hepatitis, whose incidence

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[26] Averting a Full-blown HIV/AIDS Epidemic in China – A Report of the CSIS HIV/AIDS Delegation to China 2003.

will be multiplied by global interconnectivity and travel. A major pandemic ***may*** be the instrument that causes a reverse in the process of globalization as national responses to contain infection ***will*** involve significant restrictions on personal mobility and interaction over a lengthy period. Some states ***may*** even be destabilized by the effort and resources required to address the situation.

- Rogue or Failed Cities. Owing to burgeoning populations and uncontrolled development, city authorities and regulatory mechanisms ***may*** lose the ability to maintain order, while remaining a functioning entity in the international system. This loss of control ***may*** be represented by a discrepancy between administrative and resource capacity on the one hand and human requirements on the other. Large cities in developing regions are more vulnerable to failure, with wider impacts that ***will*** be equivalent to state-failure.

- Cities' Abandonment of the Countryside. Cities, as engines of economic growth, opportunity and social inclusion in developing regions, ***may*** increasingly abandon their impoverished hinterlands, giving them up to poverty, backwardness and lawlessness, or, in more secure areas, mass tourism or industrialized agriculture.

- Mass Population Displacement. A combination of resource pressure, climate change and the pursuit of economic advantage ***may*** stimulate rapid large scale shifts in population. In particular, Sub-Saharan populations ***will*** be drawn towards the Mediterranean, Europe and the Middle East, while in Southern Asia coastal inundation, environmental pressure on land and acute economic competition ***will*** affect large populations in Bangladesh and on the East coast of India. Similar effects ***may*** be felt in the major East Asian archipelagos, while low-lying islands ***may*** become uninhabitable.

- Generation Conflict in Developed Countries. The declining size of working populations and rising social, health and pension costs in developed countries, financed through taxation, ***will*** increase the financial burden on the younger elements of society. Further exacerbation by unaffordable house prices, student debt and unemployment, contrasted with the wealth locked up in older generations, ***may*** lead to protests on a wide scale, resulting in instability and social unrest.

Defence and Security Implications

- Increased Humanitarian Commitments. The impacts of climate change, particularly the growing risk of natural disasters and the damaging effects on development for already fragile states, ***may*** increase the pressure for military forces to participate in growing numbers of humanitarian assistance, disaster relief and evacuation operations.

- **Securing Natural Resources.** Key natural resources, especially oil, gas and minerals of strategic value, **will** continue to be sourced from unstable areas and unreliable regions. Maintaining access and containing instability risks in these areas is therefore **likely** to increase in importance, alongside wider developmental and stabilization roles. Where oil and gas sources are located in areas of doubtful security, military intervention **may** be used to protect the integrity of sites and to secure investments.

- **Emerging Powers.** China and India's growing global economic status **will** translate into a significant increase in their international political influence, diplomatic power and **possibly** foreign overseas commitments, especially in their regional near-abroad. This trend **may** lead to increasing strategic competition between them where their emerging markets, sources of raw materials, interests and national priorities coincide and conflict. It **may** also lead to competitive tendering for allies and partners and possibly an Asian arms race.

- **Spending Priorities.** Increased mobility of capital in a globalized economy **may** reduce the capacity for state-based systems to levy tax and maintain fiscal stability. Governments **will** increasingly attempt to shed public responsibilities where they can and **will** be presented with increasingly challenging spending choices, including the priority that is afforded to defence and security.

- **US Economic Vulnerability.** The perception of the US as an ultimate guarantor of international security and the health of the international economic engine, able to intervene politically and militarily in unstable areas and in the settlement of intractable problems, is central to the stability of the present international system. A US economic downturn, resulting in its reduced international posture, **may** lead to increased global tension, inter-state rivalry and a greater military provision, and **possibly** intervention, by other nations.

- **Developmental Failure.** The failure of some regions and countries to achieve self-sustaining development progress **will** continue to pose instability risks, with **likely** impacts on their neighbours and the operation of the wider international system. The scale and intensification of these risks are **likely** to elicit military responses from those countries or blocs whose interests are threatened.

- **HIV/ AIDS.** HIV/AIDS **will** reduce the effectiveness and morale of armed forces of those nations worse affected and **will** continue to affect the ability of some nations to field significant military capabilities.

- **Mega-City Failure.** A large city in a developing region (or a number of large cities in more than one region) **may** fail before 2035. The effects **will** be equivalent in character, if not in scale, to state failure, which city failure **may**, in turn, precipitate.

Based on recent experience, the military stabilization of a major city would demand a comprehensive Inter-Agency approach, specialist skills, and an enduring operational commitment.

- Endemic Urban-Based, Irregular Conflict. It is **likely** that unregulated urbanization **will** result in future adversaries who have highly-developed urban survival and combat skills. They **may** consequently choose to pursue their objectives and conduct operations in sprawling towns and cities which **will** already have experienced endemic lawlessness and high levels of violence.

- Vehicle Transformation. At some stage, choices **will** need to be made in developed societies about the economic viability of vehicles and systems that are reliant on oil at a time when other sources of energy, such as liquefied coal or generated electricity, **may** be more cost effective and environmentally acceptable. This consideration would have significant implications across Defence, although some platforms and systems **may** have to be specifically designated as prioritized oil users until technology allows a practical alternative.

Potential Trend Variation

The most **probable** trends suggest that resource competition and challenges over the next 30 years **will** be substantial, complex and varying in their impact. However, alternative views offer a less pessimistic perspective. For example, as indicated above, there is considerable uncertainty about the precise pattern and impacts of climate change and, while **unlikely**, these could be less severe than predicted. Indeed, some regions **may** benefit (for example, parts of Russia, Canada and Brazil **may** be able to increase cereal crop yields and acreage under cultivation). Similarly, whilst the pressure on natural resources and energy supplies is **likely** to become more severe, the development of new technologies or discovery of large new reserves of natural resources **may** offer a more optimistic outcome.

Most economic assessments out to 2020 predict continued growth with parallel development in other areas of human activity. However, assessments beyond this point are less certain and are subject to a wide variety of variables, particularly when related to ratios of population and resources. The globalization of markets **may** be more pervasive in regions which we predict are **likely** to be subject to lower levels of economic penetration. A less even process of globalization **may** lead to lower-density settlement patterns, with people straddling rural and urban-based livelihoods, resulting in extensive browning of the countryside. The resource-rich areas of non-coastal Africa could **possibly** experience economic development at higher than predicted rates, in step with increased governance and accountability. Similarly, it is **possible** that advances in medicine could result in affordable treatments for HIV/AIDS, which **may** also unlock the economic potential in the most affected regions. However, the disruptive impacts of globalization

may result in the increased adoption of protectionist measures, either at the national or regional level, slowing international institutional reform.

Hot Topic – Competition for Energy

The Golden Age of cheap energy has passed. Competition for energy supplies **will** dominate the economic landscape during the next 30 years and world energy demand growth is **likely** to rise annually by between 1.5 and 3.1%. Sustained high demand from fast-developing economies such as China and India **will** increase significantly, while established consumers are **likely** to seek to maintain levels of consumption consistent with sustaining their own growth. This trend is **likely** to result in highly competitive pricing and the continued enrichment and economic progress of producer countries, including Russia and Iran. This in turn **will** lead to enhanced possibilities for international influence and leverage by producers and they are **likely** to allow favoured or politically useful countries to make preferential deals. In response, governments are increasingly **likely** to follow China's example and seek ways to bypass the uncertainties and volatilities of the global energy market, by establishing bilateral arrangements with individual suppliers, particularly in Africa, South America and other developing countries with unstable regimes. This tendency is **likely** to be strongest among fast-developing economies whose economic growth **will** depend on increasing manufacturing output and social amelioration, but which cannot compete on price within a global market. The prospect, apparent or real, of the peak production of oil during the timeframe out to 2035 and progressive diminution of output thereafter **will** intensify competition for remaining resources.

Disputes **may** arise for a number of reasons. Requirements to access sources of supply in unstable regions or countries could lead to intervention to protect assets and investment, while attempts to exploit new sources in the deep oceans and the polar regions could lead to confrontation over sovereignty and the terms of existing international agreements. Fragmentation or unbalanced operation of energy markets **may** fuel increased instability in producer regions; countries and communities are **likely** to respond by energy-saving measures, exploiting additional or alternative sources of energy and reducing their dependence on oil. This **will** occur through greater investment in sources such as nuclear and renewable energy, and the development of new technologies, particularly those related to fusion, hydrogen fuel cells and bio-fuels (although this **will** have an environmental impact and reduce the amount of land available for food production).

As oil supplies diminish and economic growth continues, recourse **may** be made to plentiful reserves of coal which could be: burned in power stations to generate electricity, transformed to gaseous fuels or liquefied to feed internal combustion engines. China **will** be able to exploit strategically significant coal reserves in this way. This trend **will** incur additional production and environmental burdens, although current and emerging technologies **will** assist in dealing with pollutants at a cost.
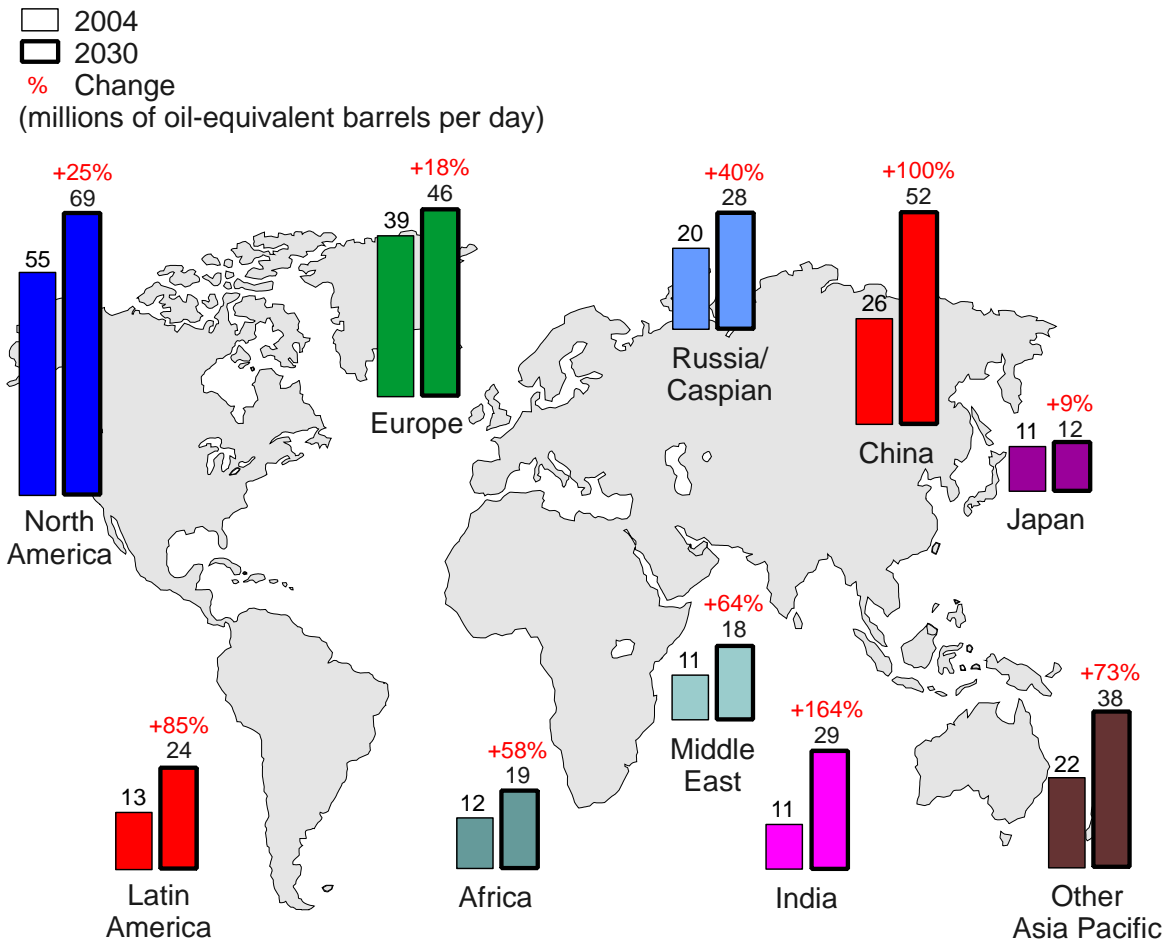
Figure 4 - Future Regional Oil Demand: While Chinese energy demand is projected to grow most rapidly, demand *will* grow from all regions. Source: Exxon Energy Outlook 2004

Social Dimension

Scope

Despite a century of major war and confrontation, economic progress, technological development and material improvement, the last 100 years have been paralleled by unprecedented growth in the world population. The *Social Dimension* examines likely population trends and assesses the social implications over the next 30 years. It also examines the changing nature of social relationships and the place of the individual within society and considers how individuals might interact with and understand the future, and it considers how they might construct personal identity strategies, both legal and illegal, to mitigate risks and exploit opportunities during the next 30 years.

The *Social Dimension* analyses trends in:

- Demography and population.

- Class, family and gender.

- Culture, identity, morality and belief.

- The individual and society - citizenship and the social contract.

- Illegal actors – criminals and terrorists.

The *Hot Topic* in this dimension is *The Media and Society.*

Outcomes

Developments in the *Social Dimension will* be dominated by 2 processes: rapid demographic change and the impact of globalization on culture, identity and belief. The world's population is *likely* to increase by over 20%[27] by 2035, most of which *will* occur in developing regions. Here, the character of society *will* be transformed by the movement of youthful populations (87% of people under the age of 25 live in the developing world)[28] from the country to rapidly-growing urban areas. By contrast, the populations in most affluent societies *will* decline, encouraging labour and humanitarian migration from less wealthy regions. Environmental pressures, economic stagnation and political instability are also *likely* to trigger population movement from afflicted regions.

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[27] World population 1950-2050 by projection variants: UN Population Division of the Department of Economics and Social Affairs, 2005.
[28] Ibid.

Increased demand for labour mobility is *likely* to be paralleled by trends towards an expansion in numbers of women in the workplace, where they are increasingly *likely* to occupy leadership positions in business and politics. Similarly, as the family changes in character and utility, shaped both by long-term population movement and labour mobility, greater migration *will* encourage cross-cultural partnerships. Decreasing fertility and informal partnerships are *likely* to result in smaller families; however, pressure on housing *may* lead to more extended family arrangements within one household, *possibly* with inter-generational dependencies. There *will* be a trend towards certainty and stability, especially in pre-modern and faith-based societies, where families and individuals *will* seek to construct a more secure and predictable social environment in an increasingly dynamic economic environment. A similar reaction *may* also be expected in middle elements of affluent societies when individuals see it in their interest to do so.

All of these changes *will* be reflected in culture, identity and belief. For many people, affiliation *will* extend beyond physically proximate communities, reflecting the ability to sustain relationships and identities over distance through globalized communications and travel. However, while resulting cultural complexity is *likely* to reinforce a trend towards secularism, a significant minority *will* turn to religious orthodoxy as a source of comfort and certainty in a changing world. The combination of growing secularism in Europe and the spread of evangelical Christianity in Africa, Asia and South America *will* influence traditionally Western-based Christian institutions, giving them an increasingly non-European emphasis.

Most of the urban poor *will* be employed in the informal sector and *will* be highly vulnerable to externally-derived economic shocks and illicit exploitation. Youthful, economically-exposed populations in the developing world are *likely* to be highly volatile, resulting in periodic social upheaval, widespread criminality and shifting allegiances. In many developing societies, the middle classes *will* grow to numerically and electorally significant levels for the first time. While this *will* reflect economic growth, most new middle class members *will* be vulnerable to downward mobility and risk; they are *likely* to compare their own living standards, possibly unfavourably, with global levels of wealth. Resulting fears and concerns are *likely* to impact on national politics and international relationships.

Those who offer radical, but superficially simple solutions to the challenges arising from a globalized economy are *likely* to find a ready audience among those who do not enjoy its advantages. For some, the temptation to 'strike back' at perceived sources of disadvantage, while offering a return to earlier certainties *will* have particular appeal, and *may* spawn rejectionist, anarchist and nihilist groups and individuals. International terrorism and irregular activity are therefore *likely* to endure and proliferate, fuelled as much by global market forces as by political and cultural challenges associated with them. Globalization *will* also provide diverse opportunities for criminal organizations, which *will*

increasingly exploit adaptable and flexible networks that *will* challenge conventional law-enforcement approaches.

Risks

- Population Growth and Demographics. Global population is *likely* to rise by 2bn to 8.5 bn in 2035,[29] most of which *will* take place in the developing world. Between now and 2035, less developed regions *will* account for 98% of world population growth, with a population increase of 38%. Sub-Saharan Africa *will* grow by 81% and Middle Eastern countries by 132%. In contrast, Europe *will* lose 40m people as fertility declines.[30] Countries and regions where young adults comprise more than 40%[31] of the population are statistically more than twice as *likely* to experience societal conflict compared with those with smaller numbers of young people. In contrast, Europe, Japan and eventually China *will* face a decline in population growth combined with a trend towards population ageing unprecedented in world history. Unemployment, gender imbalance and poor prospects *will* intensify existing tensions and pressures.

- Mass Population Displacement. Conflict and crises *will* continue to trigger the displacement of large numbers of people, mainly into proximate regions, which *may* themselves be at risk of instability. Recent conflicts have also demonstrated the potential for sudden movements of people over longer distances, with the potential for related shocks and knock-on effects. This instability is *likely* to fuel extremist politics in some societies, *possibly* based on a beleaguered middle class, which *may* result in resurgent nationalism and authoritarianism.

- Super-Diversity. Countries which encourage immigration as a means to address labour and skill shortages, involving a mixture of temporary visitors and long-term settlers, *will* increasingly experience 'super-diversity',[32] which *may* present challenges and threats to social cohesion and economic stability in host countries. In addition, the risk of a continuing 'brain drain' is *likely* to remain a challenge for some developing countries throughout this period, although evidence suggests that talented individuals *will* usually return to politically stable and economically successful countries of origin. Failure to manage this migration *will* impose significant resource burdens in destination and transit countries.

- Declining Civic Values. Many people in affluent societies *will* increasingly regard their relationship with the state in consumerist rather than civic terms, while

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[29] World population 1950-2050 by projection variants: UN Population Division of the Department of Economics and Social Affairs, 2005.

[30] ibid

[31] Professor Jack Goldstone, George Mason University, Mackinder Forum 14 Mar 06.

[32] Professor Steven Vertovec, University of Oxford: http://lists.ysu.edu/pipermail/urbanth-1/2006-February/000821.html

governmental arrangements in many developing societies are *likely* to fail to keep pace with economic and social change. These changes *will* alter the social contract between the citizen and society, which is *likely* to result in citizens becoming more self-reliant and therefore expecting a reduced obligation to the state in return.

- Political Extremism.   The middle class *will* be more vulnerable to economic and social volatility. This *may* trigger a rise in political engagement and *may* encourage a resort to either communitarian solutions or extremist politics. While the immediate risk *may* exist at the national level, exposure to globalized economic forces *may* cause a reaction to globalization and ultimately fuel tension and difficulties at international levels.

- Feminized and Male-Dominated Societies.   The issue of gender balance and weight of influence *will* continue to dominate the world's social and political agenda. Gender balance *will* be determined by culture, belief and social structures, with varying degrees of equality and advantage. Divergence between feminized societies, where women achieve greater representation, and male-dominated societies is increasingly *likely*. This disparity is *likely* to be reflected in all aspects of a culture or society and *may* stimulate growing friction between the two, *possibly* leading to outright hostility, with the former regarding the latter as uncivilized and the latter regarding the former as decadent or irreligious.

- Declining News Quality.   The rise of internet-enabled, citizen-journalists and formal, real-time and informal news distribution through themed websites and the blogosphere *will* weaken the immediacy and influence of mainstream news providers. Breaking events *will* increasingly be transmitted to individuals directly, often without filters, legal sanctions and safeguards. Consequently, competition in a real-time news environment is *likely* to reduce the integrity of the editorial function, with pressure to release stories, narratives and opinions at the expense of facts.

- Growth in Crime.   Criminals and illicit groups *will* increasingly take advantage of legitimate company structures to conduct or hide their criminal activity, leading to higher levels of global corruption and illicit trade, often involving the use of cyberspace. They *will* also continue to exploit ungoverned and uncontrolled spaces, collaborating through business-based relationships with paramilitary/terrorist and insurgent groups as well as weak and corrupt governments. They *will* exploit growing consumer markets in rapidly growing economies and opportunities wherever they present themselves. Criminals are *likely* to be more aggressive in defence of their assets and markets and in promoting their interests.

Defence and Security Implications

- **Recruitment.**   The armed forces in societies that have a declining proportion of young people, through demography, policy or disease, *may* find it progressively difficult to attract suitable or sufficient recruits. This trend is *likely* to be exacerbated by extended full-time education and a consequently greater age at which people *will* enter an increasingly competitive market for labour. This *may* lead to an expansion of technical applications, *possibly* coupled to increasing recourse to the use of foreign or commercial manpower and security solutions, especially for deployed or enduring tasks. Conversely, societies with a larger proportion of youth in their populations are *likely* to experience difficulties in meeting immediate or long-term aspirations and in containing tensions, especially in those countries which have few opportunities for growth, employment and settled occupations. In areas of weak governance, loose control and economic stagnation, these tensions could lead to endemic internalized violence or externally focused aggression, migration or expansion.

- **Evolving Family Systems.**   Family arrangements *will* become both economically and socially more diverse and fluid, shaped by culture, interest and circumstances and characterized by a combination of biological and functional relationships. However, traditional arrangements are *likely* to persist and formal marriage is *likely* to remain popular, but their character and resilience *will* be determined by economic conditions and prevailing cultural assumptions. In response to globalization and the pressures of a more uncertain world, networks based on family, clan or tribe structures and extended kinship groups, in common with a more communitarian approach, are *likely* to proliferate, especially in areas of declining or low prosperity and opportunity.

- **Work-Life Balance.**   In developed, prosperous societies a premium *will* be placed on achieving balanced work-life ratios, more engaged parenting by both partners and increasingly flexible, portfolio-based approaches to work and personal arrangements, which *will* challenge the demands of a career in the armed forces. As extra-uterine and other controlled options for childbirth become clinically feasible and socially acceptable, further shifts in male/female relationships *may* reasonably be expected.

- **Responding to Social Instability.**   Social transformation arising from globalization, demographic imbalances and economic shifts *will* result in wide-ranging, often intense, instability risks, whose impacts *will* be transmitted beyond their immediate point of origin. These features *will* demand sensitive warning, strong governance and responsive containment arrangements. In an unstable economic environment or in the event of social crisis, an increase in militancy and activism, *possibly*

based on a declining middle-class, is *likely* to fuel extremist politics in some societies, *possibly* characterized by resurgent nationalism and authoritarianism.

- Achieving Security Consensus.   Those societies most affected by the decline of civic values and which have substantial unassimilated diasporae *will* be the most exposed to super-diversity. They are *likely* to find it increasingly difficult to achieve political consensus on responses to future security and regional challenges. In addition, more attention *will* be needed in relation to the requirements of dealing with internal dissent and disorder, as well as the possibility of violent or disruptive action (*possibly* in the form of terrorism or irregular activity) in support of external causes or hostile states.

- Women in the Armed Forces.   Differentiation of gender-roles in employment *will* diminish in many developed and, increasingly, in developing societies, except when economic circumstances or traditional customs reinforce familiar patterns. However, continuing divisions between feminized and male-dominated societies *may* reinforce other sources of mutual tension. The contrast between the two *will* be powerfully symbolized by the increased profile and influence of women in the armed forces of the former, including in command and combat roles. This is *likely* to complicate relationships with both allies and opponents. Sensitivities about the employment of women in direct combat roles are *likely* to persist, although their role in countering irregular activity, combat support and other arms *will* increase and normalize during the period.

- Value Shift.   Societies that experience significant economic decline or social attrition are *likely* to experience a resurgence of traditionalist and communitarian values. Where a reverse is sudden and severe, reactions are *likely* to be dramatic, *possibly* leading to a marked decrease in Defence spending and in retrenchment, with secondary effects on membership of alliances and on established security arrangements and commitments.

- Armed Forces in Society.   A decline in civic values, the spread of super-diversity and progressively ageing populations, as well as the absence of a defined, tangible military threat, are *likely* to undermine the social and perceived significance of the armed forces in developed societies.

The Media and the Military – Iraq March 2003 - Source: Defence Images

- Use of the Media. The expansion of the media in all its forms (traditional tele-visual, the internet, and citizen journalists), *will* impact across every aspect of life. It *will* in turn be influenced and affected by novel personal devices and techniques that *will* further complicate the medium within which perceptions, expectations and opinions are shaped. States and non-state actors, as well as opportunists and other individuals, *will* seek to dominate the agenda of the 24 hour news media for commercial, political and personal reasons. In conflict and crisis, regimes and power structures *will* seek to influence perceptions and limit the freedom of action of other political and military leaders, especially those of an opponent. In some hostile or unstable conflict environments, it *will* not be possible to exploit traditional media techniques and unfiltered news *may* play an increasingly influential role. In other circumstances, certain regimes are *likely* to attempt, with varying degrees of success, to restrain or limit the effect of media coverage and its transmission to audiences, either through technical or coercive means. This *will* be easier to achieve in more autocratic or totalitarian regimes, or where media outlets are directly exposed to the risk of unrestrained violence.

Potential Trend Variation

The world's population *may* grow more rapidly than expected, even against a background of declining fertility levels. The UN's high variant population estimate is a global population of 9.2bn by 2035,[33] with a fall in fertility rates of 0.25%. This would reinforce many of the risks associated with the most *likely* projected demographic trends. Regional instability would *probably* spread with an accelerating incidence of disorder, instability and ultimately conflict. Humanitarian disaster and inter-communal risks would increase among expanding, already vulnerable, populations and there would *probably* be even greater migration flows from affected regions.

Alternatively, globalization processes *may* be less anarchic than anticipated, stimulating strong governance mechanisms and cultural convergence, rather than creating increased cultural complexity and competition. Under these circumstances, the opportunities offered by the rapid growth of highly integrated markets *may* reduce the significance of cultural identity as a determinant of personal loyalty, security and interest. Cultural convergence *may* also reinforce trends towards pragmatism, compromise and relativism, reducing the appeal of extreme ideologies and movements. Increasingly shared assumptions and values *may* also enable the international community to respond more effectively to challenges that affect the planet as a whole and that threaten stability.

Hot Topic – The Media in Society

The influence, power and stature of media organizations, both physical and web-based, *will* continue to expand, coinciding with a reduction in the ability and authority of all but the most authoritarian governments to dominate and influence the terms of debate. Confrontational and intrusive journalism, 'the Industrialization of Gossip',[34] and populist entertainment including sport, driven by commercial impulse, competition and accelerating technological development, *will* dominate the media environment. There *will* be a wide diversity of receiving mechanisms for individuals, with increasing numbers of portable, personalized and networked applications and a multiplicity of media sources. The basis of 'truth' *will* be heavily subjective and the media *will* be vulnerable to hijacking and distortion by pressure groups and fashionable ideas. This will be defined by what is believed rather than by objective analysis and scrutiny.

The expansion of commercial and unofficial, web-based applications *will* challenge the primacy of traditional corporate tele-visual and print based formats. Similarly, the emergence of 'citizen-journalists' operating independently of traditional Main Stream Media (MSM) outlets *will* participate actively across the whole future media environment, fuelled by widespread access to the successor technologies to digital audio-visual recording devices, such as digital video cameras and camera-phones. 'Advocacy-

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[33] World population 1950-2050 by projection variants: UN Population Division of the Department of Economics and Social Affairs, 2005.

[34] Andrew Marr, "My Trade: A Short History of British Journalism", Macmillan, 2004.

journalists', ranging from pressure groups to terrorists, *will* stage the news events that they cover and compete in political processes. MSM *will* feed off these sources, but also use these techniques themselves, encouraging a trend away from traditional editorial functions, responsibility and quality control. Given these trends, governments in 'closed' societies *will* find it increasingly difficult to control the spread of news and information, especially where there is a shift to internationalized or shared sources.

The power and ubiquity of the media *will* increase the tendency towards populist and personality-based politics in democratic electorates, with confidence in politicians centred on administrative and executive competence rather than issues. Governments, political parties and administrative organs *will* be subject to pervasive scrutiny and challenge by individuals and groups, who *will* form a constantly shifting pattern of pressure and lobby groups at the expense of monolithic political parties in democratic societies. This *will* be fed by, and *will* encourage, informal groupings, communitarian solutions to local problems and the spread of libertarian and individualistic values.

Significantly, a continuing divide *will* exist between the preoccupations and interests of the inhabitants of the developed and developing world and those poorest societies and communities, who *will* be the losers in an era of globalization. It is therefore *likely* that major events (political crises, disasters and conflicts) in the least connected regions could be effectively disregarded by local elites and even the wider world community. Societies in the developed and developing worlds *may* become increasingly inured to stories of conflict, famine and death in these areas and, to an extent, desensitized.

The Political Dimension

Scope

Three main features dominated international political affairs towards the end of the twentieth century: the nation-state was the primary form of sovereign actor; the existence of international organizations and agreements, through which relations between states were increasingly regulated; and the pre-eminence of the US as the sole superpower and guarantor of a post-1945 rules-based system. The **Political Dimension** considers the extent to which these features will endure over the next 30 years, taking into account possible changes in the nature and sources of power, and specific developments in various regions of the world.

The **Political Dimension** analyses trends in:

- The State and the international system.

- Non-government actors and soft power.

- The US and the Americas.

- Europe.

- Russia and its 'Near Abroad'.

- China and East Asia.

- Japan and the Pacific.

- India, Central and South Asia.

- The Gulf, the Middle East and North Africa.

- Sub-Saharan Africa.

The **Hot Topic** in this dimension is **Soft Power**.

Outcomes

The period until 2035 **will** be characterized by the increasing interdependence of nation states through a globalized economy, a commonly accepted rules-based system (honoured both in the observance and the breach) and the persistence of multilateral institutions and *ad hoc* groupings. Interdependencies **will** be characterized and reinforced by increasing global interconnectedness in the form of international investment and free

markets in goods, labour and services, although those countries that perceive themselves to be losing out in an era of globalization are *likely* to resist its advance through barriers and tariffs. Other features *will* be continued US economic, cultural and military leadership for at least the first decade or so, tempered by the emergence of more diffuse 'soft' cultural and political power and the transition to a more multilateral world; the rise of new powers, especially China and India, but also and less obviously, Brazil, Iran and a resource-rich Russia. Despite the survival of traditional alliances and associations, there *will* be a complex network of bilateral and multiple linkages, reflecting the diverse, complicated interests, risks and concerns of elites, countries and communities. The last 2 trends *will* be reflected in a tendency for intercommunal conflict to take on a transnational dimension, currently represented by the activities of diaspora communities and particularly by extreme Islamist militants and terrorists. Although large-scale interstate warfare is *unlikely*, competition for finite resources and intolerance at market forces *may* lead to tension and greater potential for confrontation and conflict between 2020 and 2035. While globalization has been seen as essentially a transmission of Western, and particularly, US values, the rise of Asian powers, the increasing purchasing power of their populations and their growing influence in international institutions is *likely* to stimulate the dissemination of more Asian cultural values and offer alternatives to the Western model of global culture.

The US is *likely* to sustain its international leadership until at least 2020, after which a more multipolar world *will* challenge its hegemonic status, with China, Russia, India, Brazil and Indonesia and a host of alternative, possibly rival polities weakening its grip on certain regions and the international system. US strategic power *will* also be progressively diluted by its integration within an increasingly globalized economy and the need to address large budgetary imbalances and deficits.

Brazil's emergence as a major economic power based on continued democratic institutions, a diverse economy and vast potential as a food and bio-fuel exporter, *will* alter the balance of power in the Americas, along with a progressive reduction of dependence on the US by South American countries. Brazil's economic development is *likely* to be a catalyst for similar progress by other South American states, particularly Argentina and Chile, although such development throughout the region *may* be complicated by a resurgent populism which *will* have substantial appeal to the 25% of the population of Latin America which live on less than $2 a day .[35]

The EU *will* grow to absorb new members and *will* associate its future security with stability on the North African littoral and the Middle East; however, further constitutional and monetary integration *may* be hampered by competing national expectations and under-performing economic output. In particular, the combination of ageing populations and generous social programmes *may* be incompatible with continued economic growth

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[35] Omar Arias, William Maloney and Humberto Lopez, 'Poverty Reduction and Growth: Virtuous and Vicious Circles', World Bank, Feb 2006.

and EU members *may* struggle to maintain living standards. The tension between globalization and existing state welfare and economic provision is *likely* to result in uneven impacts across the EU and *will* include unemployment, pressures on infrastructures and a popular move towards more traditional, conservative and communitarian ways of life. The gap between the pan-European, liberal elites and public opinion is *likely* to widen. Increasing the birth rate and encouraging more immigration *will* require sensitive social policies, to ensure control of the balance between population and resources and stable integration. The democratic reforms of the 1990s *may* come under pressure in the states of the Former Soviet Union and Eastern Europe, if democratic institutions fail to deliver prosperity and stability. In these circumstances the temptation to revert to more traditionally authoritarian regimes is *likely* to be strong, but *will* be counter-balanced by the continued desire and need to remain part of the EU and NATO.

Russia's significance and influence in Europe is *likely* to increase, reflecting its extensive natural resources, particularly in oil and gas, but its ability to exert direct leverage or leadership *will* be limited by its internal tensions, not least its acute demographic crisis, threats to stability from radical Islam and severe regional instability on its southern periphery. The failure of Russia to diversify its economy from a single sector based on energy, as a 'Saudi Arabia of the North', *may* result in stunted economic development and huge inequalities resulting in political stasis and the potential for instability and disorder. This tendency *will* be perpetuated by ongoing difficulties in generating a self-sustaining middle class, significant levels of civic responsibility and a socio-economic model based on the rule of law. A failure to overcome these problems is *likely*, given historic experience, to result in an increasingly authoritarian, overtly nationalistic posture, characterized by a highly regulated, but irregular and criminalized economic sector and poor democratic credentials. Assertive Russian nationalism *will* be opposed by the re-emergence of a pan-Islamic identity, especially in those areas of the Caucasus and Central Asia where poverty is widespread, outside exploitation is rife and Islam is rapidly filling the politico-social vacuum left by the collapse of communism.

China *will* overtake Japan as the world's second largest economy by 2015, thus continuing a putative rise to great power status derived from its economic growth. Its dependence and impact on an increasingly integrated global economy is *likely* to be reflected in a highly pragmatic approach to foreign affairs. However, China *will* face significant internal political, environmental and social challenges including a democratic deficit, demographic imbalances - induced by the momentum of its 'one-child' policy and selective gender practices - a steadily ageing population and a significant, hitherto poorly mapped, HIV/AIDS problem. Furthermore, continuing disparities in wealth and opportunity, severe environmental degradation, water and agricultural stress, a dire need of financial reform and pervasive corruption at all levels of society are *likely* to lead to societal conflict and political disruptions.

China's growth depends on access to raw materials at competitive prices, a continuing appetite in the developed and developing world for its exports and security of the international system. In future, it *may* seek to exert economic muscle or other hard power to protect growth and internal stability. Any non-consensual change to Taiwan's status is *likely*, with little warning, to destabilize rapidly China's relations with the international community, in particular the US. Continued economic growth *may* also create further regional rivalry and competition with an increasingly confident and vigorous India. Once China has established itself as a major world power, possibly as early as 2025, it *may* feel less constrained in its behaviour, presenting greater challenges to an international system.

China *will* itself be subject to internal stresses and strains, including marked regional disparities that *may* result in widespread social disturbance and disorder. Its traditional hierarchical society is already in conflict with the transparency, competitiveness and individual initiative associated with Western values and globalization. These tensions *will* be added to the huge social cost of China's economic growth, typified by alarming levels of inequality between rich and poor, the coast and the hinterland, the cities and the countryside and the command-led exploitation of the country, regardless of environmental or social cohesion effects. The trajectory suggests that aggressive nationalism and competition *may* become features of China's future engagement with the wider world. It is noteworthy in this regard that, by 2025, China *will* have about 40m single men and a rapidly ageing society with no discernible pension provision, health-care or social security system in place. These aspects are *likely* to be further exacerbated by rapid environmental degradation, water shortage and the desertification of already arid and semi-arid regions.

Japan's position as the world's second largest economy *will* be challenged by Chinese growth, huge government debt which amounts to 170% of GDP[36] and an ageing population. The economy has recovered from the Asian stock market crash of the late 1990s with a programme of banking and business reform, which *will* be necessary to ensure continued Japanese economic prosperity. Japan is *likely* to demonstrate a growing willingness to shoulder broader international security burdens alongside the US[37] thereby maintaining the more consciously assertive foreign policy demonstrated by the deployment of Japan's Self Defence Forces to Iraq in 2004. This reflects Japan's need to be able to respond to regional security challenges such as the potential collapse or aggression of North Korea, or *unlikely*, but still plausible, Chinese hostility or aggression.

Indonesia's vast population, under-exploited natural resources and geo-strategic situation *may* give it the potential for vigorous economic growth. However, substantial challenges *will* remain in the form of a diverse multiracial society with a number of violent separatist movements and endemic instability. It is also extremely vulnerable to the *possibility* of

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[36] www.cia.gov - CIA World Factbook.
[37] The Economist 8 Jul 04 – 'From Pacifism to Populism'.

serious natural disasters caused by seismic and volcanic activity along a particularly temperamental tectonic fault-line.

India **will** dominate South Asia, but **will** face challenges of its own, including its chaotic infrastructure, extensive rural poverty, a widespread yet under reported HIV/AIDS epidemic and its relationship with a poor, nuclear-armed Pakistan, and also, emerging Iran. The relationship between India and Pakistan is **likely** to deteriorate rapidly if a radical Islamist government comes to power in Pakistan or if the country spirals out of control. Furthermore, the persistence of caste mentalities, the exploitation of the benefits of globalization and growth by the upper and middle classes and the persistence of Hindu/Muslim extremism suggest that India's future progress **may** be slowed to some degree by political and societal instability, and **possibly** conflict. The inability of India's state education system to generate a sufficiently well educated work force to man its expanding technical services industry **may** also stall its economic growth. India's democratic institutions and Anglophone culture **will** however give it advantages for participation in the global economy, although, by 2035, the growth of Asian economies **will** have created a more Asian and less Anglo-centric identity for globalization.

The Middle East – and to a marginally lesser extent North Africa - **will** remain highly unstable, with, between them, massive population growth of 25% by 2010 and 50% by 2020 and poor prospects for employment and diversification from its dependence on a single sector; oil production. The expectations of growing numbers of young people, many of whom **will** be confronted by the prospect of endemic unemployment, poor infrastructure and economic stagnation, are **unlikely** to be met. Their resentment in the face of unrepresentative regimes **will** find outlets in political militancy, including radical political Islam, whose concept of *Umma*, the global Islamic community, and resistance to capitalism **may** lie uneasily in an international system based on nation-states and global market forces.
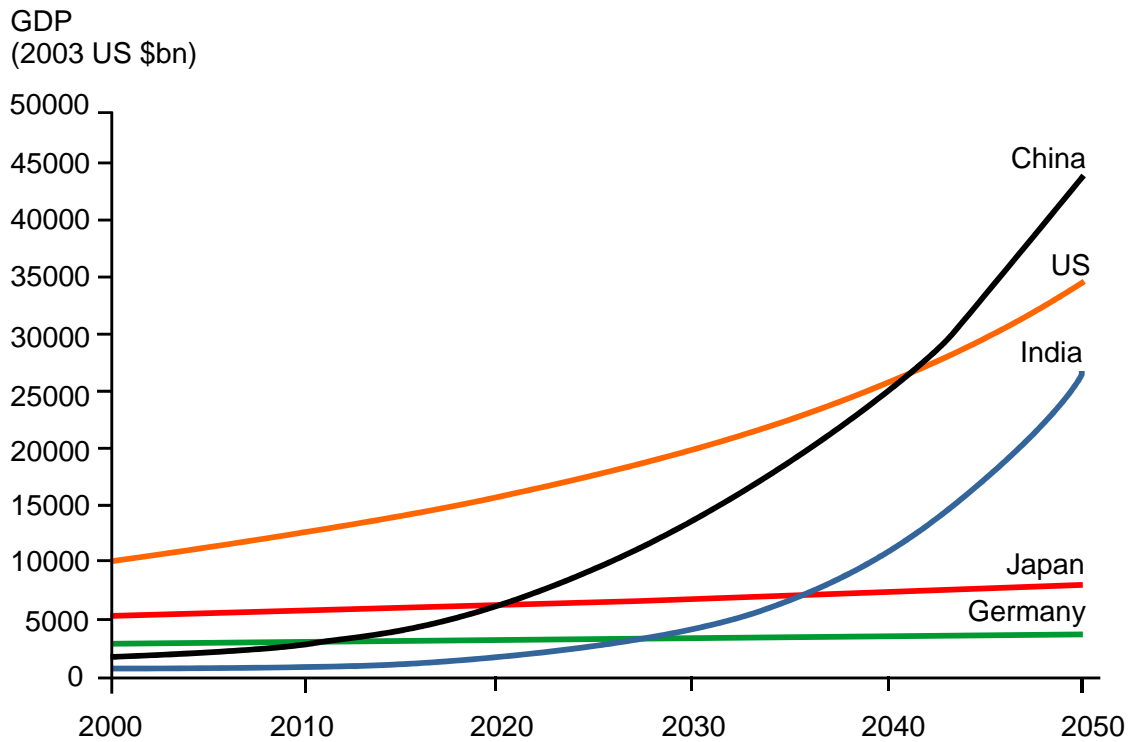
GDP
(2003 US $bn)

Figure 5 - GDP of emerging powers showing dramatic projected growth for India and China. Source: Goldman Sachs

The effects of this resentment *will* be expressed through the migration of large youth populations and globalized communications, enabling regular contact between diaspora communities and states of origin. Furthermore, many aspects of the modern world which appear incompatible with Islam, particularly its more extreme interpretations, *will* further fuel tension between the Islamic world and the wealthy, materialist and secular nations of the West in general and the US in particular. Such hostility *may* increasingly be targeted at China, whose new-found materialism, economic vibrancy and institutionalized atheism *will* be an anathema to orthodox Islam. In the longer term, internal political debate and demographic trends within Iran *may* lead it in an internationally less threatening direction. Israel *will* be challenged by a combination of widespread regional disturbances, marked demographic imbalances, the Arab desire to project and focus frustration outwards and the need to sustain a totemic pan-Islamist cause.

Sub-Saharan Africa *will* gain only marginal benefit from a globalized economy while poverty, intercommunal conflict and widespread instability *will* remain endemic. While some countries, especially Nigeria and South Africa, *may* have the potential for energetic economic growth, the generational imbalances caused by the ravages of HIV/AIDS *will* compromise the stable development of future generations. The continuing poverty and lack of opportunity in Sub-Saharan Africa, together with environmental degradation and change, *will* require increased levels of humanitarian assistance and intervention.

Without stabilizing policies, migration from south to north in the Continent is *likely* to increase greatly during the period, with severe implications for the countries of North Africa. Despite manifest social, economic and demographic challenges, African wealth in resources, such as minerals in South Africa and oil in Nigeria, *will* attract intense interest from global extractive industries and *may* stimulate a latter-day "Scramble for Africa".

Risks

- New Geopolitics.   Global economic and financial interdependency is *likely* to reduce, but not eliminate, the risk of major interstate warfare before 2020. However, increasing pressure on resources, particularly energy, and the growing assertiveness of emerging powers such as India, China and Iran, beyond this date *may* result in the return of great power rivalries as the defining characteristic of geopolitics, with a consequent increase in the risk of interstate and inter-bloc conflict.

- Militant Political Islam.   Militant political Islam *may* coalesce, evolving beyond currently loose patterns of affiliation, with a clearer sense of common identity developing among members of disparate Islamic communities. Globalized communications *may* provide the means to bring together communities who *may* increasingly see political Islam as a suitable vehicle and ideology for addressing demands for global economic and social justice.

- Ungoverned Space.   Areas that lie beyond effective governance *will* increase to include extensive urban areas, which *will* grow rapidly and in an unstructured way in developing countries, and *will* lack resources, municipal infrastructure and the rule of law. So-called 'ungoverned spaces' of all kinds *will* provide havens from which terrorist organizations, gangs and organized criminals can operate, exploiting the complex human and built space.

- Nuclear Proliferation.   The proliferation of nuclear weapons possession beyond the existing powers, particularly to weak and unstable states, *will* increase the risks of more uninhibited, assertive and intemperate behaviour by these polities while reducing their susceptibility to conventional methods of coercion. Also, the possession of nuclear weapons by states, whose capacity for ensuring their security and safety *may* be inadequate, *will* increase the risk of these technologies and associated materials being incompetently handled or acquired by third parties, including non-state actors such as criminals and terrorists. This aspect *may* lead to an increased risk of potentially catastrophic environmental damage as well as creating substantial new global and regional security challenges.
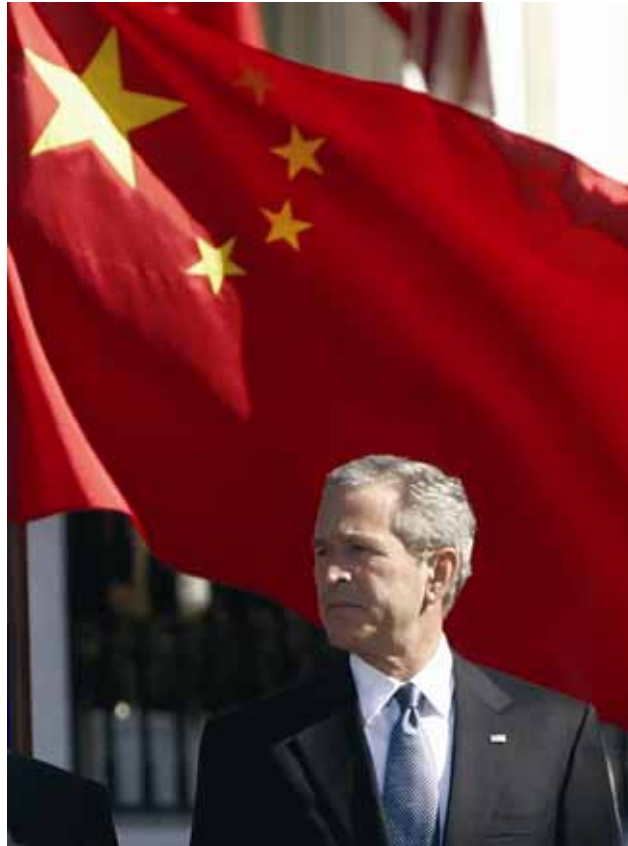
Ascending China – President George.W Bush waiting to meet the Chinese President Hu Jintao, the White House April 20th 2006 - Source: Empics.com

- Ascending China.   China is *likely* to maintain a pragmatic approach to the conduct of international relations, with foreign policy and economic investment decisions unconstrained by ethical considerations. However, environmental, demographic and economic stress *may* lead to internal unrest, which a future Chinese government *may* seek to project externally, coupled with a desire to dominate her near-abroad in East Asia. This aspect *may* revive historic tensions and *possibly* military confrontation, with traditional regional rivals such as Japan, Korea and the US. Taiwanese and other separatism, which *will* be opposed vigorously by Beijing, together with the need to secure resources to sustain economic growth, *may* encourage a more forward leaning posture.

- US Decouples from Europe.   A shift in the US strategic focus towards Asia, as well as a changing balance of power in the Americas, based on Brazil's economic growth, *may* result in a significant reduction in its engagement with Europe and challenge the viability of NATO as the dominant provider of European security and defence architecture. However, the US *will* need to safeguard its continuing interests in the Middle East, particularly the region's energy resources and its

relationship with Israel, and these are *likely* to ensure continuing defence and security cooperation with European partners, ***probably*** at reduced in-place levels, but with a correspondingly greater investment in expeditionary and Continental US-based quick reaction capabilities.

- Middle East Instability.   High birth rates and demographic momentum in the Arab world, combined with poor economic prospects, widespread regional instability and continuing *likely* failure to resolve the Israel/Palestine conflict *will* exacerbate existing regional tensions, with wider international implications, given the vital strategic significance of the region's energy resources and proximity to other possible flash points. Israel *will* face consistent hostility, demographic pressure and aggression from the wider Islamic world.

- Saudi Arabian Instability.   Saudi Arabia is the dominant member of OPEC with 22% of the world's oil reserves. Owing to ever increasing global demand for energy to support economic growth, especially in Asia, Saudi Arabia's future stability *will* be crucial to achieving sustained global economic activity. This stability *will* be challenged by several factors including: Jihadist terrorists discouraging foreign participation in the energy industry; unemployment levels of over 20%; and a continuing 'youth bulge' in a state whose population has risen from 7 to 27 million since 1980.[38] Any political or societal dislocation in Saudi Arabia *will* have global implications.

- North Korea Implodes.   North Korea is *likely* to become increasingly brittle over time through economic mismanagement, demographic pressure and environmental stress, threatening eventual political collapse. Resulting risks *will* range from sudden mass population movements into neighbouring states, to the threat of conflict by a nuclear-armed regime increasingly aware of the imminent risk of its own collapse and its potential to blackmail the international community. The unification of Korea is a distinct possibility during the period, with implications for South Korea in taking on the substantial unification burden, and for the region, especially Japan, of contemplating a nuclear-armed Korea.

- India-Pakistan.   Long-standing tensions between these regional rivals are *likely* to threaten military confrontation, with the ultimate, but at present distant, risk of regional nuclear conflict. A collapse of Pakistan's current political structures in the face of continued radicalization and extremist violence and its transformation into an unstable, nuclear-armed entity would present a more dangerous risk for the region.

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[38] Ian Bremmer, 'The J-Curve; A New Way to Understand why Nations Rise and Fall', Simon and Schuster, 2006.

- Iranian Assertiveness.   Iran **will** steadily grow in economic and demographic strength, based on its oil and gas reserves, its central geo-strategic situation and its rapidly increasing youth population. Its large energy resources and geographical location at the entrance to the Persian Gulf **will** give it substantial strategic leverage. In the first part of the period, its regional ambitions **will** involve active support of Islamist terrorist organizations, the assertion of its primacy in the Gulf region and the desire to develop its own nuclear weapon capability. Its foreign policy **will** continue to involve a closer relationship with China and Russia and continued suspicion of the US and the West, as long as it is in the interests of the governing regime to do so. However, from the middle of the period, the country, especially its high proportion of younger people, **will** want to benefit from increased access to globalization and diversity, and it **may** be that Iran progressively, but unevenly transforms, with growing prosperity and the pressure of demographics, into a vibrant democracy.

- European Stagnation.   Slowing of momentum towards greater political integration by the EU and **likely** economic and political divergence among its enlarged membership **may** result in a general weakening of its potential for situational development and coherence. This **may** render European states increasingly vulnerable to globalized challenges, such as economic competition, mass migration, terrorism, international crime and climate change, to which no single nation can respond effectively. On the other hand, this combination of challenges **may** lead to greater cooperation, based around mutual or bilateral self-interest and common causes or threats. The potential for populism, revived nationalism and economic protectionism **will** remain high in the face of globalization, ageing and social fragmentation. Further momentum for greater political integration is **unlikely** unless stimulated by the re-emergence of a significant, tangible and immediate threat to European security.

- UN Decline.   Failure by the UN to reform and to exert leadership would be **likely** to result in eroding its credibility and authority, as well as its ability to resolve conflict and deal with the symptoms and challenges of global crisis. This **may** encourage individual powers or new groupings to fill the vacuum, but international consensus or expression of the common will are **unlikely** to be achieved and those intervening **may** pursue individual ends based on pragmatic self-interest rather than the common good, thereby expanding the risks of wider confrontation and conflict.

Defence & Security Implications

- Transnational, Inter-communal Conflict.   Transnational, inter-communal conflict **may** increase as a result of migration and the persistence of unassimilated diasporae, leading to the diversification of hitherto localized rivalries. Globalized

processes **will** also enable conflict between communities to be continued, irrespective of the physical distance between them.

- Irregular Activity.   In the absence of direct, open state-on-state conflict, there **will** be a marked increase in the prevalence of irregular activity. Most **will** demonstrate features associated with criminality, terrorism, disorder and insurgency, fuelled by nominal or actual grievance, deprivation and resentment, or simply in reaction to market forces or boredom. There **will** also be increased sponsorship of irregular activity and groups by states, seeking to utilize and exploit, through proxy, gaps in the international system, either to assert themselves or secure advantage without exposing themselves to state-on-state risks. Armed criminal, terrorist or insurgent groups, trained and experienced in conflicts and struggles around the world and knowing no other existence, **will** be part of the strategic landscape and **will** need to be identified and countered.

- Islamist Terrorism.   Acts of extreme violence, supported by elements within Islamist states, with sophisticated networks and media exploitation to maximize the impact of the 'Theatre of Violence' **will** continue to persist. Unassimilated Muslim diaspora populations in Europe **will** harbour elements, **possibly** well armed and violent, dedicated to disrupting and destabilizing host societies, **possibly** leading to social disorder and violence. The disparate character of Islam, combined with selective interpretations of scripture by its adherents, **will** give rise to divisions that **may**, depending on location and circumstances, either exacerbate or mitigate these effects.

- Soft Power.   The ability to use and counter 'Soft power',[39] centred on access to target audiences through projection of culture, investment, education, development and other non-coercive means **will** be of increasing significance to both state and non-state actors. It **may** enable more discriminating use of the military instrument of power.

- Rising China and India.   Both China and India are **likely** to play an increasingly active role in international security arrangements, reflecting their growing global economic interests and regional influence. China's role **will** become especially significant, based on a growing range of partners and clients, particularly among world energy producers, and its need for stability in the international system. China's growing economic power, combined with its institutionalized atheism, **may** create tension between it and the Islamic world although China's ruthless pragmatism **may** find means of accommodation. It is also **possible** that India and China, in competing for the same markets and partners **may** become strategic rivals. Equally, however, they **may** combine to exclude Western influence from

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[39] 'Soft power' is defined as cooption rather than coercion and rests on the ability to shape the preferences of others; its resources are values, culture, policies and institutions.

Asia and from the Indian Ocean, the East Asian archipelagic zone and the South China Sea.

- **The Nuclear Club.**   Exceptional states with nuclear weapons, such as Pakistan, possibly North Korea, and potentially Iran, *will* remain vulnerable to instability until at least 2020 and the collapse of central authority in any of them would increase already significant proliferation risks. In time, other potentially unstable nations and non-state actors, *may* develop or acquire access to such capabilities, requiring the development of responses to both irrational use and the risk of control failure by nuclear armed states.

- **Russia.**   Russia is *unlikely* to threaten its Western neighbours with direct military force, although its wealth in energy resources *will* give it substantial strategic leverage. Its military strategic priorities are *likely* to remain concerned with maintaining high capability and quality nuclear and defence forces and the ability to respond to instability internally and around its periphery, particularly in the Caucasus. Russia *may* develop and favour a twin track approach whereby it emerges as a strategic partner with Europe and a strategic competitor in Asia. In all cases, it *will* seek to exclude Western, especially US, influence and investment in Central Asia and its near-abroad.

- **The Middle East.**   The Middle East's potential for instability, its proximity to Europe and its importance as a source of energy *will* ensure that the region remains an area of significant security concern, *probably* demanding substantial operational commitment to bolster stability and secure access, as well as containment of the more violent symptoms of crisis.

- **Africa.**   Environmental stress, demographic pressure and political instability *will* continue to threaten major upheaval, the effects of which *will* include mass migration, humanitarian crises, international crime and potentially, international terrorism. The resulting risks to near neighbours, including Europe, will demand wide-ranging defence and security responses. African mineral wealth will ensure continued economic significance within the global economy and corresponding interest from more economically powerful states.

- **Future European Defence Capabilities.**   NATO is *likely* to remain the defence and security provider of choice for European states. However, gradual US disengagement from Europe as a consequence of increasing strategic challenges in the Asia-Pacific region and the changing political complexion of South America, coupled with any failure of NATO to meet its operational objectives in theatres such as Afghanistan, *may* weaken the case for NATO and its effectiveness as an international alliance. EU defence collaboration is *likely* to develop under the aegis of the European Security and Defence Policy (ESDP), especially in response

to instability in the Middle East and North Africa. However, it is **unlikely** to achieve the levels of cohesion in military command or levels of resources available to NATO. Similarly, EU military ambitions **will** be constrained by limited defence spending by European nations. Increased political and security emphasis **will** be required to ensure stable co-existence with the North African littoral and new partners to the East and innovative, flexible security arrangements **may** be required. A national resurgence based on authoritarian government and energy wealth **may** result in increased Russian, or even Chinese, influence on Europe.

- Maritime Security. Most of the world's trade, by bulk, particularly energy, **will** continue to transit by sea and through maritime choke points such as the Straits of Hormuz, the Suez Canal and the Straits of Malacca, in areas which **will** remain highly unstable. This **will** demand high levels of international cooperation and a continuing dependence on the deployment of maritime power.

- Force Projection. In the face of political, human and financial risks of intervention, developed states **may** be increasingly reluctant to expend resources and manpower on failed states and ungoverned space. Significant forces are **unlikely** to be sent abroad for enduring operations without the consent of the local population and in the absence of an unequivocal international mandate or a credible national benefit. There is **likely** to be more emphasis on the active containment of aggressors, symptoms of crisis and irregular elements, to deter and defeat military threats to partners and the international system. In these circumstances, the ability to secure and maintain free access to areas of strategic and operational interest **will** remain vital.

Potential Trend Variation

Global economic and financial interdependency **will** ensure that the effects of any major regional or national economic downturn **will** be felt throughout the developed world. In response to such failure, individual states **may** seek to reverse the trend towards globalization and close borders and markets in an attempt to protect their populations from the consequences of deep economic recession. Such a reduction of interdependency, combined with social tensions arising from economic hardship, **may** create conditions of regional instability, making interstate conflict more common and **likely**. A return to more clearly defined national and regional blocs **may** be compounded by failure of multinational institutions such as an unreformed UN or a moribund EU.

Political and market reform in the Middle East and Sub-Saharan Africa **may** allow the development of broader economic activity and consequent economic growth, thereby reducing the stimuli for instability, conflict, disorder and forced migration. Such economic improvements **may** allow hitherto undeveloped areas to exploit the advantages of the global economy, leading to sustainable development and poverty reduction. Such

changes in the Middle East and North Africa, as well as closer alignment of interests with the EU, *may* assist in offsetting the extreme politicization of Islam, in stimulating greater prosperity, the alleviation of absolute poverty and an easing of tensions with the West. It would seem *likely* that other states will seek the status and assurances associated with nuclear weapons.

Hot Topic – Soft Power

During the next 30 years, globalization and especially the Information Revolution *will* significantly enhance the impact and utility of Soft Power. Growing inter-connectedness *will* enable groups and individuals to coalesce around common interests in ways which transcend national boundaries. An important feature *will* be the attraction of participants to those ideas, cultures and lifestyles that offer the greatest potential for securing and advancing their interests.

While the US model of individual freedom, expression and opportunity has substantially prevailed as an aspiration, the EU has been markedly successful as a Soft Power attractor and China is already proving, through its promotion of Chinese culture, language and infrastructure projects abroad that it intends to deploy significant Soft Power in the future. The main features of the Chinese approach are *likely* to be entrepreneurial, pragmatic and the promotion of a pan-Asian affinity.

Increasingly, Soft Power *will* be wielded by a broader spectrum of actors and agencies, even by criminal, terrorist and insurgency groups as a means of complementing their more coercive, violent activities. Investment in infrastructures, charities and humanitarian projects *will* increasingly represent ways in which states, organizations and individuals seek influence, democratic or populist approval and loyalty. These groupings *will* be highly volatile, dissolving either when interests are achieved, or when more favourable opportunities present themselves, with those least constrained by legal accountability or moral considerations the most *likely* to be effective at manipulating the use of Soft Power. For example, terrorists *will* exploit globalized communications to maximise the apparent potency and appeal of their actions, not only to intimidate victim communities, but also as a Soft Power attractor among potential communities of support.

Science & Technology

Scope

For much of the last century, Research and Development (R&D) was preoccupied with the need to maintain an edge in a succession of 2 global wars and the confrontation associated with the Cold War, with benefits and innovations leading to wider commercial applications. By the closing years of the twentieth century, this relationship was transformed by the Information Revolution, the decline in the immediacy of interstate warfare and an unparalleled growth in global trade, entrepreneurial investment and technological innovation.

The Science & Technology Dimension considers how innovation might unfold over the next 30 years, dealing, in particular, with the rapidly expanding global appetite and market for scientific knowledge, the influence of emerging economies and the resulting potential for technology breakthroughs. It also considers the ethical and regulatory challenges that may result from these processes and analyses trends in:

- The nature and geography of innovation.

- Potential technology breakthroughs.

- ICT.

- Regulation, control and ethics.

The *Hot Topic* in this dimension is *The Scramble for Space*.

Outcomes

Technology is *likely* to produce breakthrough events at an unprecedented rate in the period to out 2035. Whilst government and military funded research *will* continue to provide significant novel, niche applications especially in Russia, China and the US, the overall pace and direction of technological development is *likely* to be driven by globalized demand and commercial logic. The Information Revolution and increasing numbers of graduate level engineers and science professionals in the developing world *will* further stimulate the process. Under these conditions, knowledge and innovation *will* become more diffuse and internationalized, accelerating the development process, but also making the likelihood and frequency of breakthroughs less predictable. The changing pattern of global R&D and the mobility of labour *will* assist innovation and *will* erode the technological dominance of leading Western nations, including in the Defence field, although it *will* be some time before US levels of investment and achievement in this crucial field are seriously challenged. The diffusion of innovation and scientific

development, especially through the expansion of hi-tech business and solutions worldwide, is *likely* to increase the risk of technology leakage and irresponsible or illicit use.

Global economic growth, cheaper commodities and wider accessibility *will* sustain demand for technological applications, thus improving material living standards for most of the world's population. Technology *may* mitigate issues that contribute to global instability; innovations in energy technology *may* reduce pressure on markets dominated by oil, either through the development of new sources, or the evolution of current hydrocarbon technology to include carbon capture and the manufacturing of synthetic fuels. Similarly, breakthroughs in agriculture and medicine *may* increase food security and improve health. However, it is more *likely* that there will be a widening gap between those people with sufficient means and access to these developments through their inherent advantages of wealth, education and market reform, and those who have not. Many of the latter *will* continue to be concentrated in regions which are least integrated within the globalized economy, where human security risks, poverty and technical backwardness are greatest.

While it *will* be difficult to predict particular breakthroughs, trend analysis indicates that the most substantial technological developments *will* be in: ICT, biotechnology, energy, cognitive science, smart materials and sensor/network technology. Advanced nanotechnology *will* underpin many breakthroughs, (See text box). Developments in these areas are *likely* to be evolutionary, but where disciplines interact, such as in the combination of Cognitive Science and ICT to produce advanced decision-support tools, developments are *likely* to be revolutionary, resulting in the greatest opportunities for novel or decisive application. Most technological breakthroughs *will* be positive, however, many advances *will* also present potential threats, either through perverse applications, such as the use of genetic engineering to produce designer bio-weapons or unstable substances, or through the unanticipated consequences of experimental technological innovation.

Greater connectivity and accessibility to information through the proliferation of ICT *will* stimulate intensifying international debate on ethics, regulation and law, and *will* cause religious, ethical and moral concerns and disputes. The pace and diffusion of R&D and the operation of commercial imperatives *will* make global regulation difficult and *will* increase the opportunities for unethical or irresponsible actors to evade control. In addition, the effectiveness of regulation is *likely* to vary by culture, region or country, with an uneven application of, and access to, innovation. However, these issues are *likely* to be highly politicized and the issues are *likely*, on past evidence, to cause localized disorder and possibly organized violence.

Areas of Potential Scientific and Technological Breakthrough

Nanotechnology - Advanced nanotechnology, at the interdisciplinary frontier where physics, chemistry and biology meet, *will* be a key enabler of technological advance and *will* underpin many breakthroughs, including materials and sensor development and their application in manufacturing, synthetic reproduction and health care. Nanotechnology *will* result in more-capable systems and artefacts that are smaller, lighter, cheaper and less energy hungry. Out to 2020, its application is *likely* to be predominantly in electronics and materials, including bacteria resistant agents, stain resistant materials and nanocomposite materials. After 2020, nanodevices are *likely*, such as nanobots.

ICT - By the end of the period it is *likely* that the majority of the global population will find it difficult to 'turn the outside world off'. ICT[40] is *likely* to be so pervasive that people are permanently connected to a network or two-way data stream with inherent challenges to civil liberties; being disconnected could be considered suspicious. There are a number of trends that *will* lead to this pervasiveness including: an expanding global economy, potentially far-reaching improvements in processing power, greater cultural assimilation and awareness of technology, and the continued convergence of information and communication technologies. In turn, ICT *will* itself be a major engine of growth for the global economy.

Biotechnology - Development in biotechnology is *likely* to be swift as indicated by the significant increase in global biotech revenues ($23bn in 2000 to $50bn in 2005[41]) and the purchase by large pharmaceutical companies of biotech firms in order to secure the most likely avenue for future drug blockbuster development[42]. Advances in the understanding of the building blocks of life *will* lead to significant progress in many areas such as genetic engineering and microbiology. We can expect an increase in human life span through better disease control, precisely customised drugs, gene therapy and age mitigation (and *possibly* age reversal). Quality of life *will* also improve through, for example, the development of bionic implants, memory enhancing drugs, increased use of animal transplants, development of artificial sensors capable of interfacing with the human mind and prosthetics capable of mimicking human actions precisely, improving human performance beyond current levels. Stem cell and tissue engineering are *likely* to offer novel forms of treatment for missing, damaged or diseased tissue.[43] Biotechnology also has the potential to increase food production and quality/nutritional value through Genetic Modification (GM), (for example, 'Golden Rice' containing fortified vitamin A is now available in Africa and South East Asia). However, the high cost of biotechnology R&D, at least initially, the large variation in the quality and efficiency of processing, delivery and

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[40] ICT is the entire infrastructure, organization, personnel, and components that collect, process, store, transmit, display, disseminate and act on information.
[41] 'Profitless Prosperity' – Page 76 - The Economist 22 Apr 06.
[42] *Ibid*
[43] *Ibid*

distribution networks are *likely* to make the application and benefits of biotechnology uneven.

New Energy Technology - New sources of power generation are *likely* to become commercially available and viable during the period. However, advances *may* be evolutionary rather than revolutionary during the first half of the period owing to the legacy of, and sunk investment in, current methods of oil-based energy conversion, remaining, accessible oil stocks and the *likely* viability of manufacturing oil, particularly from shale and coal. This evolutionary approach *may* continue to expose the global market to price fluctuations and risk based on hydrocarbon dependency. Towards the end of the period, major advances are anticipated in other sources, *possibly* including nuclear fusion. There is *likely* to be a strong market for smaller, more efficient autonomous power supplies throughout the period, which is *likely* to lead to accelerated research in ethanol, methanol, hydrogen and radical fuel cell options. Renewable energy sources *will* also find niche markets as indicated by the success of bio-fuels in Brazil, but these are only expected to make up 8% of global energy supply by 2020.[44]

Cognitive Science - Routes to the direct application of advances in cognitive science are less clear than nanotechnology or biotechnology; however, indications are that interdisciplinary advances involving cognitive science are *likely* to enable us more effectively to map cognitive processes. Soft Artificial Intelligence is already well established with self diagnosing and self reconfiguring networks in use and self repairing networks *likely* in the next 10 years. Mapping of human brain functions and the replication of genuine intelligence is *possible* before 2035.

Sensor and Network Technology - Our reliance on networks and the complex nature of our environment, often with poorly understood properties, *will* increase. Higher bandwidth, greater processing power, larger datasets, smaller sensors and greater understanding of the dynamics of physical and virtual network behaviour *will* converge to allow new types of network connection. However, the growth of many networks is not and cannot be governed by top-down planning and occurs in a decentralized manner, often analogous to naturally occurring systems. There is therefore a need to understand network topology in order to improve effectiveness and reduce vulnerability; for example, disease can travel more readily through certain types of network with implications both for epidemiology and for the spread of viruses through the internet.[45]

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[44] US National Intelligence Council – 'Mapping the Global Future' Dec 04.

[45] Dr Harry Woodroof, Leader, Delta (S&T) Scan, Horizon Scanning Centre, Office of Science and Technology.

Risks

- **Uncertainty.** In a fast-changing area, it is difficult and foolish, outside the realms of science fiction, to forecast in any depth technological breakthroughs or their likely applications. Many of the interrelated effects of globalization, including market-manipulation by existing stakeholders, the unpredictability of consumer demand and complex routes to market, *will* make predictions for the future even less certain. Many issues, including control regimes, *will* have to be addressed as they arise, although it might be anticipated that some issues *will* become highly charged.

- **Unintended Consequences.** The accelerating pace of innovation and the possible rewards *will* increase the likelihood and frequency of breakthroughs, any of which *may* result in unintended consequences, with potentially catastrophic effects. Conversely, there *may* be political pressure to adopt a precautionary or regulatory protectionist approach. For example, European public concerns over genetically-modified crops and other products could inhibit research, causing the benefits of technological progress to dissipate and allowing other regions to take the lead.

- **Dependence on Technology.** The breadth and depth of the application of innovation *will* generate an unprecedented reliance on technology. Increased access to and the rapid cultural assimilation of technology *will* render future generations increasingly vulnerable to the deliberate or unintentional disruption of technology-based utilities. Sophisticated societies are *likely* to be more vulnerable to such disruption as they increasingly exist in a virtual environment in contrast to less technologically advanced societies.

- **Information Explosion.** Responding to the increased speed and volume of information *will* challenge effective decision-making progressively at all levels. Greater personal, corporate and military dependence on ICT and commercial inter-connectedness and applications *will* create greater vulnerabilities and fragility, magnifying the impact of information denial, failure or manipulation. The Internet *will* cause continuing leakage and diffusion of sensitive and potentially dangerous information about weapons and disruptive technology. The truth *will* not always be based on objective analysis but on what 'is believed'.

- **Narrowing Technological Advantage**. The relocation of high value-added technology manufacturing in emerging countries and developing economies (associated with the transfer of technical expertise, including production design) *will* soon result in a narrowing and, in some cases, the complete erosion of the advantage currently enjoyed by leading economies in many areas of technology.

The problem **will** be exacerbated by industrial espionage on a large scale and the penetration of commercial networks.

- The Role of Artificial Intelligence.   The simulation of cognitive processes using Artificial Intelligence (AI) is **likely** to be employed to manage knowledge and support decision-making, with applications across government and commercial sectors. Reliance on AI **will** create new vulnerabilities that are **likely** be exploited by criminals, terrorists or other opponents.

- Authenticity of Information.   The information environment **will** become increasingly crowded and of variable authenticity, with a proliferation of chat rooms, weblogs and themed websites, which **will** attract growing numbers of Internet users, for example, the number of Internet hosts worldwide grew from 6.64 m in Jul 95 to 353.28 m in Jul 05.[46] Information **will** increasingly be circulated through, and processed and generated by, these and more advanced media, becoming progressively more difficult to source and validate.

- Erosion of Civil Liberties.   Technology **will** enable pervasive surveillance in response to terrorism, rising transnational crime and the growing capability of disparate groups or individuals to inflict catastrophic damage or disruption. Coupled with intrusive, highly responsive and accessible data-bases, the emergence of a so-called 'surveillance society' **will** increasingly challenge assumptions about privacy, with corresponding impacts on civil liberties and human rights. These capabilities **will** be deployed by the private as well as the public sector.

- Ethical Challenges.   The rate of innovation is **likely** to result in a significant lag between radical innovations and the development of ethical norms governing their application. Also, the diffuse nature of innovation **may** make it easier for unethical actors to evade controls, leading to perverse applications - for example, genetic information could be used to exploit or attack specific ethnic groups.

- Inequality.   Scientific breakthroughs are **likely** to have the potential to improve the quality of life for many, for example in the safe genetic modification of crops or through stem cell research. However, a combination of market pricing or ethically based regulation **may** obstruct access by those who might wish or need to benefit most, thereby reinforcing inequality and a sense of grievance.

Defence and Security Implications

- Information Warfare.   Many states are developing highly sophisticated information and cultural warfare capabilities and exploiting the pervasiveness and pliability of

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[46] Internet Systems Consortium.

digital information to gain commercial or political advantage. In addition, the threat of opportunistic hacking and network manipulation *will* continue, but at an increasing rate and intensity as criminals move into fresh markets. Both *will* represent a significant threat to military ICT systems, which *will* require robust and comprehensive protection, fall-back options that do not depend on commercial bearers and unhindered access to exclusive space-based (or intra-atmospheric) platforms.

- Encryption.   Along with the increasing use of obscure languages and commercially available 'strong' encryption, enhanced software and more agile broadband applications *may* reduce the capacity of Western intelligence penetration and exploitation in cyber-space. In addition, if significant developments in quantum computing occur, sufficient encryption algorithms *may* be unlocked to provide strategic advantage to the discoverer.

- Technology Leakage.   Despite multi-lateral regulation and security, deliberate and accidental technology leakage, through internet and other digital devices, as well as telecommunications and the media, *will* lead to a widening number of state and non-state actors accessing advanced and sensitive technologies. This *may* result in the acquisition by state or non-state opponents of CBRN, or novel weapons such as Directed Energy or Electromagnetic Pulse technologies and devices. So-called ethical scientists are *likely* (as in the Cold War) to reveal details of advanced programmes in the interests of ensuring a 'level playing field' and balance of risk.

- Defence R&D.   The role of Defence R&D is *likely* to mainly shift from the development of new technologies, to partnerships that can access and exploit technologies that are the products of commercially funded research. States that wish to maintain a technological advantage in military capability will *probably* require R&D programmes that are capable of drawing from an increasingly diverse global knowledge and technology base, and then adapting and applying that technology to military use.[47]

- Rapid Obsolescence.   The predicted pace of innovation is *likely* to render existing technologies obsolescent more quickly than at present, challenging procurement cycles and closing the technology gap by allowing less technologically capable states, regimes and groups to embrace new technology without having to upgrade legacy systems.

- Defence Niches.   Certain sensitive applications, such as decisive or revolutionary systems and weapons, especially those associated with deterrence and mass

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[47] 'Defence and Peace Economics': Andrew Middleton DG(R&T), MOD, Apr 06.

effect, *will* increasingly be developed in discreet (and discrete) partnerships. Specific national or closely allied expertise and investment *will* be required to address, for example nuclear, counter-terrorism and chemical and biological defence. In these cases, the supplier is *likely* to remain in-house to Defence, or government-to-government. Direct investment *will* also remain important where there is no civilian counterpart, such as high-performance explosives, certain protection and guidance systems, and specific sensors.

- Ethical Intervention.   The scientific community *will* seek to influence policy-making, especially in Western societies and 'whistle-blowing' *will* become more likely, particularly in ethically-charged areas, such as the application of technology for defence and security purposes. Furthermore, the incidence of ethical, cultural, religious or legal controls and constraints is *likely* to be uneven, offering those with less regulatory control the opportunity for significant and potentially asymmetric advantage.

- Wider Availability of Affordable Technology.   The wider availability of affordable technology that has both military and commercial use *will* benefit the less technologically capable, particularly through cheap, novel applications, as in the use of mobile phones to detonate bombs.

- Rapid Mass-Mobilization.   The growing pervasiveness of ICT *will* enable communities of interest to be established rapidly and for the quick and coordinated mobilization of significant numbers of people. Rapid mobilization – 'Flashmobs' - *may* be undertaken by states, terrorists and criminals, and *may* involve dispersed communities across international boundaries, challenging security forces to match this potential agility and ability to concentrate.

- Unmanned Technologies.   Advances in autonomous systems, which promise to reduce substantially the physical risks to humans and mitigate some of their weaknesses, *will* allow the wider exploration and exploitation of extreme or hazardous environments such as deep sea, underground, contaminated areas and outer space. Furthermore, these technologies *will* allow increased Defence exploitation in all environments with a correspondingly reduced risk to military personnel and an expanded range of capabilities.   AI and the effective replication of human judgement processes, when combined with autonomous systems, particularly robotics, are *likely* to enable the application of lethal force without human intervention, raising consequential legal and ethical issues.

Potential Trend Variation

R&D that is driven increasingly by commercial demand *will* make investment and innovation potentially vulnerable to economic downturn. Failure of the global economy to

grow as predicted *may* delay the development of revealed innovations and it is *possible* that all substantive innovation *may* stall. Other factors, which could cause the rate of progress to slow, include a less permissive environment for innovation, *possibly* caused by rising cultural conservatism in response to the more disruptive features of globalization and to a decline in those places where the number of graduates studying sciences has fallen. A resurgence of economic protectionism *may* also slow innovation by limiting the operation of the international knowledge economy. Finally, it is *possible*, based on historic experience, that the world *may* reach a temporary, but lasting, technology ceiling, which is impossible to penetrate without a cumulative succession of linked, but at present perceptually unrelated, breakthroughs.

Conversely, it is *possible* that innovation will take place even more rapidly than is anticipated. Breakthroughs such as the early development of quantum computing *will* add significant impetus to the pace of technological change and information processing. Specific advances *may* also have significant geopolitical impacts. For example, a breakthrough in energy technology *will* alter the global significance of the Middle East, reducing Western strategic dependence on an unstable and volatile area.
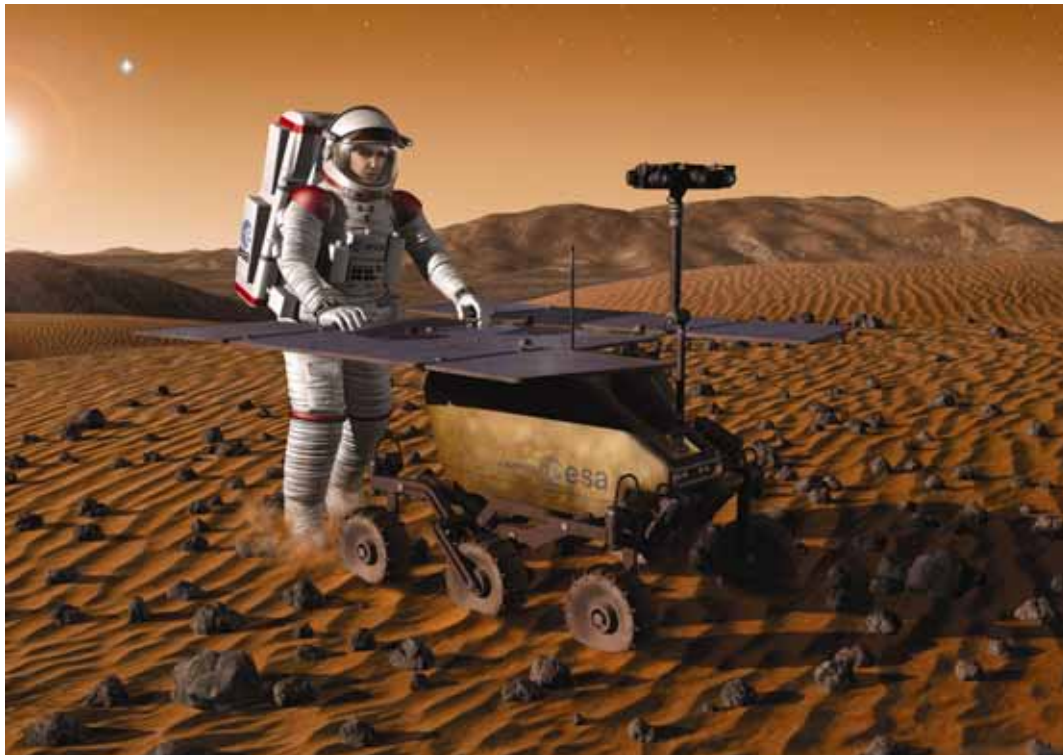
Exploration on Mars, an Artists Impression - Source: Empics.com

Hot Topic – The Scramble for Space

Since the end of the Cold War, space has generally been perceived as a benign environment. However, technology is now opening the door to space for more nations and applications and there is potential for a second space race. Whilst manned exploration of our solar system *will* remain the purview of only a few nations,[48] unmanned space-based utilities *will* become economically viable for many more nations.

Advances in enabling technologies, cheaper launch techniques and platforms *will* enable space-based programmes to operate with greater economies of scale. Emerging nations *will* utilise this increased access to space,[49] with countries such as China and India, in particular, expanding their space programmes.[50] However, reducing launch costs, more varied propulsion methods and a highly mobile and competitive technical knowledge and equipment market *will* also encourage a much broader range of nations and other actors to exploit space, as seen by recent initiatives by Algeria, Nigeria and Brazil. National prestige *will* remain a motivating factor, but the significant advantages in economic, commercial and defence and security areas offered by dual-use space utilities, *will* become increasingly attractive to states.[51]

There *will* be large and rapid increases in the capabilities of space-based utilities, with commercial off-the-shelf technology a key driver and energetic commercial activity developing towards the end of the period. The strongest growth in civil, defence and security applications *will* include: telecommunications; positioning and navigation; and earth observation. The latter is *likely* to include large numbers of agile satellites capable of being repositioned to enhance connectivity on demand, for instance, to provide enhanced media coverage of key world events. Space based systems *may* be sought to mitigate the effects of climate change, or to harness climatological features in the support of military or strategic advantage. Venus is *likely* to be a particular object of curiosity in interpreting climate change while more detailed studies of the Sun *will* enhance our understanding of solar weather. These studies *will* increase our understanding of these effects on the Earth and its environment.

There *will* be a revival of interest in manned space exploration, led by the US,[52] but quickly joined by China and Russia, to penetrate deeper into the Solar System with the Moon and Mars primary targets for extensive, *possibly* exploitative exploration. This *will* raise jurisdictional, ownership and competitive rights issues.

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[48] 'Star Wars between Russia, China and the US' – The Times online 2 Sep 06.

[49] Illustrated by the average increase in orbital launch capacity of one nation every eight years, 'Space Security 2004' – Space Security.org - ISBN 0-920231-35-7.

[50] The budget of the Indian Space Research Organisation grew in real terms by 60% between 1990 and 2000 'Space Security 2004' – Space Security.org - ISBN 0-920231-35-7.

[51] Dual-use implies commercial space utilities and hardware that could be used for military purposes, for example, commercial or civil micro-satellites that could be manoeuvred to impair or destroy other satellites.

[52] Proposed manned missions to the Moon and Mars were announced by President George W. Bush 14 Jan 04 – Office of the Press Secretary, the White House press release 14 Jan 04.

The military use of space, with the US retaining its overall lead, **will** also remain a significant driver of R&D and of competition for bearers and locations in space. Military and civilian applications that require range and visibility, particularly sensing applications, are currently moving from ground to airborne use and, as they become practically and economically viable, many of these applications **will** be increasingly exploited either in the high atmosphere or in space. The high civil and military impact of the loss of space-based utilities **will** result in an increase in measures to ensure their security, including **likely** investment in physical security that **may** involve built-in redundancy, passive protection and intelligence on potential threats. Other measures are **likely** to include international agreements to reduce potential sources of tension and disagreement, for example, access to communications frequencies and orbital locations. However, these treaties **may** prove fragile and difficult to enforce, with greater dual use blurring boundaries and adding more uncertainty in analysing the intent of satellite owners.

Given current multi-lateral agreements and technical factors, the effective weaponization of space is **unlikely** before 2020. However, nations **will** seek to inhibit the use of space by opponents through a combination of electromagnetic manipulation, hard-kill from ground-based sensor and weapon systems, the targeting of supporting ground-based infrastructure and a range of improvised measures. At its most extreme, the weaponization of space **may** eventually include the development of space-based strike weapons capable of attacking ground-based and other space targets; for example solid metal projectiles travelling at orbital velocities, so-called 'rods from the gods'. However, this **will** remain extremely **unlikely** without the prospect of sustained and extreme deterioration in international relationships and **will** be technically difficult to achieve before 2020.

'Space junk'[53] **will** require active management as the increasing volume of orbital traffic by an ever widening range of space users **will** present an increased risk to the integrity of existing systems and services through collision or other forms of interference. The potential size of the problem **will** require significant levels of investment and international collaboration, both politically and commercially.

Finally, space exploration on the scale envisaged, particularly the potential exploitation of resources on other planets, **will** require significant funding, entrepreneurial flair and a degree of financial risk taking. Such funding and risk **may** be more easily absorbed by nations that are economically vibrant yet rely less than others on democracy and capitalism, enabling them to gain a significant fiscal and R&D advantage that could ultimately lead to strategic advantage. Equally, funding is increasingly **likely** to be generated by cooperative ventures, either national, that could spawn new and unexpected inter-state allegiances, or commercial, that could erode state control of space and place control increasingly in the hands of multinational corporations or wealthy individuals.

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[53] Approximately 13,000 objects large enough to seriously damage or destroy a spacecraft were in orbit (2004) – over 90 percent of which was space debris – Space Security 2004, Space Security Org ISBN 0-920231-35-7.

The Military Dimension

Scope

Since the Cold War, the likelihood of major interstate warfare has perceptually become more remote while the possibilities for societal conflict have seemed more likely to cause confrontation and crisis. The **Military Dimension** draws on outcomes identified in the other dimensions to consider how they will shape trends in conflict and warfare for the next 30 years. In doing so, it will consider future risks of conflict, the resourcing of conflict, the extent to which conflict will take place in new contexts and use novel means, and the extent to which the expressions warfare and military activity will change.

The **Military Dimension** analyses trends in:

- Conflict and confrontation.

- Conflict environments.

- Organization and resources.

- Conflict actors and human impacts.

- Attitudes, laws and norms in conflict.

The **Hot Topic** in this dimension is **The Balance of Military Capability**.

Outcomes

Major interstate wars will be **unlikely**, because of the increasing economic interdependence of states in a globalized economy and the need to confront the symptoms of a challenging range of transnational problems, which **will** enhance the requirement for cooperative governance and action. Also, the potential increase in the number of nuclear-armed states **may** be a further restraining factor. However, the risks of inter-state war **may** increase beyond 2020 when intensifying competition for resources, particularly energy and possibly food, and continued population growth result in heightened tension.

Conflict and crisis **will** become increasingly complex and unpredictable, both in their incidence and character, during the period to 2035, with serious interstate rivalry probably expressing itself through proxy actions by hostile groups who may or may not have issues of their own. Irregular activity **will** be the prevailing theme of the period out to at least 2020, based on grievance, resentment, perceived inequalities and legacy mythologies and characterized by terrorism, insurgency, serious criminality and disorder.

Some of this activity *may* be widespread and endemic depending on local conditions and circumstances. However, overall, it *will* involve a range of active state, group and individual participants who *will* concentrate and operate, both globally and locally, wherever they can gain advantage in relation to opponents or objectives.

In the use of violence and the threat of force, military and civil distinctions *will* become blurred and weapons and technologies *will* be more widely available to potential combatants and individuals. The greatest risks of large-scale conflict *will* be in areas of economic vulnerability, poor governance, environmental and demographic stress and enduring inequality and hardship, especially where there has been a history of recurring conflict (See Figure 2). Most conflicts *will* be societal, involving civil war, intercommunal violence, insurgency, pervasive criminality and widespread disorder. However, in areas subject to significant demographic and wealth imbalances, there *will* be a risk of large scale cross-border migration and exogenous shock. Finally, a trend towards societal conflict *will* be reflected in the continuing prevalence of civilian casualties, as it takes place in increasingly urbanized situations and human networks.

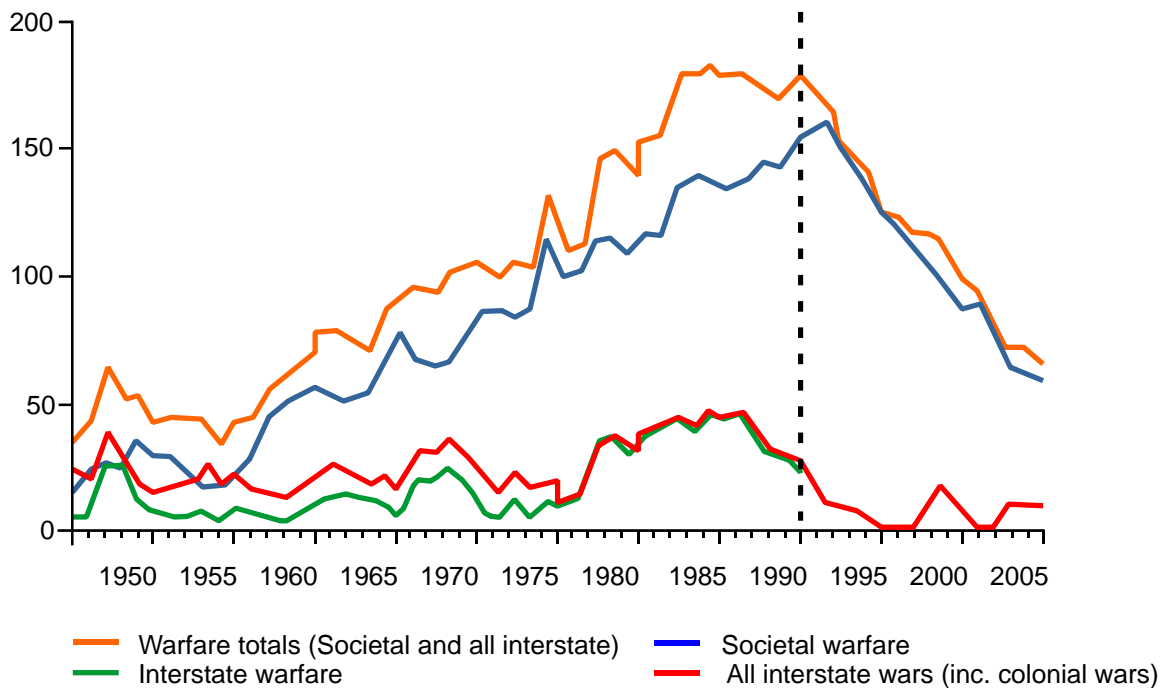|	
── Warfare totals (Societal and all interstate)	── Societal warfare
── Interstate warfare	── All interstate wars (inc. colonial wars)

Figure 6 - Global Trends in Armed Conflict: Levels of Conflict peaked during the Cold-War end-game. Future resource and other stresses may bring the subsequent lull to an end - Source: CIDCM.

The legal, technological, social and environmental contexts for conflict *will* contribute significantly to its complexity and *will* create major challenges for those engaged in the

planning and conduct of operations. Affluent and well-integrated states *will* seek to abide by international legal norms, while poor and weakly-integrated states and non-state actors are *unlikely* to be similarly constrained. When conflict does occur, richer states *will* attempt to maximize their economic and technological advantage; however, these *may* be undermined or reduced by growing affordability of new generations of weapons and the prevalence of mass effect options. Conflict itself is *likely* to take place in new environments: cyberspace, the high seas, near space, and increasingly, in expanding cities. Sprawling, rapidly and chaotically urbanized areas, especially in the developing world, which lack basic infrastructure or municipal order, *will* provide havens in which criminals, terrorists and insurgents *will* shelter and organize, and from which they *will* launch operations. Nevertheless, they *will* also seek to colonize cities and other urban centres in the developed world, notably through influence on, and infiltration of, existing structures, backed up by the threat or use of societal violence.

Blurring of Military/Non Military Boundaries – A Northern Alliance Fighter in Afghanistan 22nd November 2001 - Source: Empics.com

A further complicating factor *will* be the increasingly hazy relationship between military and non-military aspects of conflict. Civilians *will* carry out a wide range of activities

hitherto undertaken by military personnel as more comprehensive approaches are adopted. The clear distinction between combatants and non-combatants *will* be increasingly difficult to discern. Military personnel *will* also find themselves employed more often in essentially non-military roles, owing to their readiness profile, training and capacity for organized action, often as the first response to natural disasters, unexpected flash events and other serious civil contingencies. They *may* be deployed in those circumstances where the normal law enforcement agencies cannot cope, as seen recently in New Orleans and Bandar Aceh, or where opponents use capabilities that can only be countered by military levels of force. Indeed, increasingly, regular military forces *will* deploy in environments where armed irregular forces, for example armed followings, gangs, bandits, semi-official militias, Private Military Companies (PMCs), terrorists and insurgents, are operating, often as adversaries, but sometimes as neutrals or even as partners.

Therefore, while war itself *will* remain essentially violent, adversarial and characterized by the use of force in pursuit of political ends, the uncertainty of the future strategic context and the breadth of challenges to which appropriate responses require a military contribution, *will* frequently result in armed forces being deployed in actions of a more constabulary or settled nature, but with the potential for periodic or escalating violence; these *will* include Peace Support Operations and actions in response to humanitarian crises. Separation in time and space between levels of military activity, strategic, operational and tactical, and the environments within which they take place, physical and virtual, *will* also become increasingly blurred as greater use is made of networks and shared situational awareness. This *will* shape the character of military activity, demanding increased discrimination and judgement about how to deal with situations as a whole from military forces and from the political leaders who employ them. Crucially, this level of sophistication *will* require a concerted, comprehensive application of all the instruments and agencies of state power, together with cooperation from all relevant authorities and organizations involved in settling a crisis or resolving a conflict.

Risks

- Democracy is not the only show in town. The progress of the world to universal democratic ideals *will* be uneven, *possibly* uncertain, out to 2035, especially as other superficially attractive and traditional models of government continue to appeal, if only in the interests of continued stability. Indeed, the example of Iraq has not been a good advertisement for rapid democratization and universal human values. States which attempt to transition to democracy from autocratic or oligarchic government are *likely* to be particularly vulnerable to instability. When combined with other risk factors such as demography, environmental stress, a lack of natural resources and a failure to deliver economic growth, this awkward transition *will* increase the likelihood of enduring instability, disorder and conflict.

- Persistent African Instability.   Factors such as famine, environmental and demographic stress, endemic poverty, widespread HIV/AIDS and other diseases **will** endure in Africa, leading to a persistent risk of conflict in much of the Continent. This **will** not only stifle regional economic growth, but **may** actually reverse such development. The consequences, typically uncontrolled mass migration, transnational organized crime and increasing diaspora populations, **may** transmit risk beyond the region, particularly to Europe. Significant containment of these consequences **may** be required, especially in the Mediterranean, if Europeans in particular are to remain 'masters of the clock'.

- Arms Rivalry.   Increasing strategic and possibly inter-bloc competition is **likely** as a result of the emergence of major new powers. This **may** stimulate intensive arms races, for example between China and the US, or between regional rivals such as India and Pakistan, reducing resources available for peaceful economic development. The increase in arms spending would **probably** extend beyond immediate rivals to include their neighbours and partners, thus intensifying regional tensions and increasing the chances of conflict.

- Economic Downturn.   A global economic downturn **may** reduce confidence in international markets, reversing the effects of globalization. This **may** reduce or destroy economic and financial interdependencies, fragmenting markets and leading to more intense strategic competition and increasing the risks of tension and conflict.

- Unilateralism.   Inertia in international decision-making or a near-monopoly in strategic resources (by a bloc or a state) **may** lead a major power towards a unilateralist posture. This **may** in turn cause a more widespread loss of confidence in international institutions among the wider global community, reducing international capacity for general cooperation and coordination of response to crisis, while increasing the risks of confrontation and conflict. Those states which judge that they have the power to act unilaterally **will** remain more selective in their application of international law, including in armed conflict, while some actors, if their interests demand, are **likely** to refuse to be bound by it at all.

- Perverse Application of Technology.   The development of technologies that have hitherto been considered benign **may** be subverted for hostile use. For example, biotechnology and genetic engineering **may** be combined to create 'designer' bio-weapons to target crops, livestock, or particular ethnic groups.

- Nuclear Proliferation.   Accelerating nuclear proliferation **will** create a more complex and dangerous strategic environment, with the **likely** clustering of nuclear-armed states in regions that have significant potential for instability or have fears about foreign intervention. For example, North Korean, Pakistani and

potentially, Iranian nuclear weapon capability *will* increase significantly the risks of conflict in Asia if a system of mutual deterrence does not emerge. In addition, nuclear possession *may* lead to greater adventurism and irresponsible conventional and irregular behaviour, to the point of brinkmanship and misunderstanding. Finally, there is a possibility that neutron technologies may re-emerge as potential deterrent and warfighting options.

- **Proliferation of CBRN Delivery Systems.**   The variety of potential CBRN delivery systems *will* increase, to include delivery by advanced cruise missiles and unmanned aerial vehicles. These *may* become available to well-resourced terrorist groups and could be deployed from improvised land or sea platforms.

Defence & Security Implications

- **Plurality of Armed Actors.**   Armed forces in low-income states *will* operate alongside, in competition with, and against, a variety of paramilitary groups and armed criminal gangs. Sustaining a wealth of armed groups *will* place a disproportionate burden on the poorest states. However, it is highly *likely* that these actors – along with the home-grown variety - *will* find their way into settled societies and urban centres of the developed world.

- **Defence Production.**   Defence production *will* continue to become increasingly internationalized and most states *will* lack guaranteed access to the industrial surge capacity that *may* be required during periods of rising tension. The economic burden of Defence capability development is also *likely* to be concentrated in a decreasing number of states, increasing the likelihood of niche capability development and common cooperative solutions in some. This is *likely* to extend beyond platforms to include consumables, munitions in particular, which *may* be required for conflicts of even short duration. Some capacity for secure access and re-supply *will* be required, if a state is not to be out-faced and out-resourced by sub-state groups and organizations, which *may* compete on the global market for the same items and with more immediate financial liquidity.

- **Complex Environments.**   The increasing complexity of future conflict environments, including pervasive media and internet coverage, *will* pose a challenge to armed forces which operate within them, demanding new tactics, specialized equipment and heightened levels of discrimination. Military personnel at all levels *will* require increased awareness of the legal implications of their actions and sophisticated training led by objective, authoritative doctrine. The variety and changing character of the environment *may* increase the training requirement and perhaps broaden the range of skills required to generate sufficiently agile and battle-winning forces.

- Going Underground.   All likely future opponents **will** have recognized the advantages of going underground if they wish to avoid the surveillance, targeting and penetrative capabilities of sophisticated military forces, particularly those deploying air platforms and systems. In future, states **will** seek to site most of their major nodes and the majority of their decisive fighting power underground or among civilian infrastructure that it is illegal or unethical to target. Similarly, irregular opponents **will** base themselves in underground networks, both for offence and defence, especially in complex urban spaces.

- AI.   The progressive introduction of 'soft' AI and further simplification of the Human Computer Interface (HCI) is **likely** to change the emphasis in training from technical aspects of system operation to the application of judgement in the employment of systems and the conduct of operations. This **will** stimulate a cultural change with significant effects on the requirements for manpower, command structures and training.

- Technology and Fighting Power.   Successful exploitation of new technology, such as Directed Energy Weapons **will** depend on the users' understanding of both the advantages and the limitations to its application across physical, conceptual and moral components of fighting power. Those who fail to do so are **likely** to risk defeat by those who achieve a better component mix, by those who target components to which technological advantage does not apply, or by those who employ technologies such as Electromagnetic Pulse (EMP) to neutralize a more sophisticated adversary's capability. Small incremental changes in technology are also **likely** to lead to disproportionally large increases in warfighting capability and effectiveness. This is **likely** to lead to the reduction of transitional concept-to-capability timescales and increase the scope for technology leakage and more discriminating use of Off-The-Shelf (OTS) applications, especially in the areas of nano- and bio- technology.

- Cheaper, more Lethal Weapons.   Future technological development and a highly-competitive arms market are **likely** to result in weapons that are more cheap, portable, destructive, widely available and easier to use. Their mass use is **likely** to have a particularly unsettling effect in poorer, unstable regions where the expense of more capable military equipment might previously have been prohibitive. It **will** also allow less developed states and non-state actors to close the technology gap with traditionally superior adversaries.

- Deliberate Collateral Casualties.   Both state and non-state actors **may** target commercial and industrial installations to inflict mass casualties, in breach of international law, as an intended primary or secondary effect. The potential impact **may** be reinforced by increasing industrialization in developing countries, a

possible resurgence in nuclear power plant construction, and the progressive concentration of populations in urban areas.

- Nuclear Proliferation.   An increase in the number of nuclear-armed states *will* affect the ability of the world's leading military powers to undertake intervention operations. Operations that threaten the personal or regime security of autocratic leaderships in nuclear-armed states *will* entail particular risk.

- Failure of CBRN Armed States.   There *may* be a need to be prepared to conduct stabilization operations in failing or failed states or cities that possess significant CBRN weapons material and expertise. Consideration *will* have to be given to handling unstable, insecure and poorly maintained CBRN materials, securing the facilities and limiting misuse and proliferation.

- Human Nature of War Challenged by Technology.   Increasing pervasiveness and exploitation of technology at all levels of warfare *will* increase the distance between 'the point of the spear' and the point of interaction for most personnel. Such reliance on technology and unmanned, remote options is *likely* to lead to increasing vulnerability to a resurgence in traditional, mass warfighting and irregular activity. Ethical questions regarding the accountability for automated actions are also *likely* to increase.

Potential Trend Variation

A loss of confidence in globalized markets, leading towards the revival of national economics, is *possible* and *may* result in international rivalries that could increase the risks of interstate warfare. Most significantly, this would simplify the context for military activity, as military tasks would be defined increasingly in terms of unambiguous national interest and definite threat assessments. Under these conditions, international security and legal arrangements would tend towards bloc partnerships and bilateralism, reversing the current trend towards multilateral security and legal frameworks. Defence spending would *probably* increase as a proportion of national incomes (although economic slowdown might limit real growth). However, reduced commercial demand and lower levels of knowledge-sharing would *probably* slow the rate at which new technologies would become available to the Military. A significant effect *may* be an acceleration in CBRN acquisition programmes and, for developed countries, a revival of interest in neutron and smarter nuclear technologies.

Conversely, an acceleration of the integration of international security arrangements driven by globalization, is also *possible* and *may* reduce the risk of interstate warfare to the point where it becomes negligible. Instead, the focus for national military activity *may* shift more clearly than at present towards: international cooperation on reducing the risks of societal conflict; responding to civil contingencies such as natural disasters and focused

interventions against discrete threats which, like terrorism, are relatively small-scale when compared to interstate warfare. While the contexts for military activity would remain complex, greater integration at the military operational level **may** lead to convergence between the armed forces of different nations in their doctrine, organization and equipment, extending and building upon the NATO model.

Hot Topic – The Balance of Military Capability

Confronted with few direct threats and declining populations, most affluent societies **will** attempt to minimize their Defence burden by investing in conflict prevention and, for as long as it is in their interest to do so, participating in alliances, forming communities of interest and contracting out security. The US **will** be the exception, making by far the greatest commitment to Defence throughout the period, consistent with its economic power and technological advantage.

China and India's Defence spending is **likely** to increase in proportion to their economic growth and the range of their global interests and investments. After 2020, they are **likely** to have developed 2-tier armed forces, consisting of CBRN weapons and large relatively unsophisticated forces for territorial defence, and smaller higher-capability forces for power projection. For middle-income states that are not part of an alliance, military capabilities **will** typically be 10 years behind those of more affluent states. Optimized for territorial defence, they **will** find it difficult to recruit the skilled personnel required for the more complex military tasks of the future, but **may** wish, if they have a demographic advantage or a traditionally hostile near neighbour, to retain high levels of manpower for internal security, employment and national prestige.

Low-income states **will** continue to operate forces that, in principle, are organized along conventional lines, but **will** probably bear a closer resemblance to the irregular armed groupings operating locally within them. At times of heightened tension, both middle and low income states are **likely** to rely on the mass-mobilization of large-scale reserve or irregular forces which, while usually of doubtful military value, **will** add significantly to operational complexity.

Strategic Shocks

Introduction

An analysis of trends and probable outcomes can only go so far in describing the future, the unexpected also needs to be taken into account - shocks will happen. Our discussion now outlines ways in which discontinuities may occur. This section makes no claim to be a comprehensive list of all possible shocks, but does seek to demonstrate how the world might develop in ways that are radically and intuitively different from outcomes derived from linear analysis.

Global

Mount Merapi erupts in Indonesia, June 2006 – Source: Empics.com

Mega-Volcanic or Seismic Event

A major volcanic eruption or earthquake, such as that in Indonesia in 535 AD, or even Krakatoa in 1883, would have dramatic effects both regionally and globally. The violence of the eruption, along with associated seismic activity, would cause extensive disruption,

damage and loss of life. The emission of vast quantities of ash and debris into the atmosphere would be spread globally, blocking out sunlight with drastic consequences for climate and agriculture worldwide. Owing to population growth, global inter-dependency and intense habitation in areas that increasingly defy nature, the effects of any future natural disaster are likely to have correspondingly greater impact.

Thermo-Haline Disturbance

Climate change could cause a reduction in North Atlantic salinity by increasing the melt water and freshwater runoff from the Arctic. This could affect the natural circulation of the North Atlantic by diminishing the warming effect of ocean currents on Western Europe. The drop in temperature might exceed that of the miniature ice-age of the 17th – 18th centuries, driving up demand for energy for heating and closing some shipping routes in winter, while lower summer rainfall could increase water stress and reduce crop yields. However, this feature is likely to be offset by increases in temperature caused by climate change and the associated global warming.

Global Pandemic

A new untreatable virus that spreads rapidly among human populations, causing serious illness, would pose a significant threat to societies, which are both increasingly concentrated in urban settlements and also connected by modern mass-transit systems. Such an illness would be extremely difficult to contain and could have catastrophic impacts beyond its immediate medical effects, possibly including the collapse of the highly integrated global economy, with its complex networks of interdependent relationships. Similar effects might be induced by the rapid spread of disease among livestock or crops.

Methane Catastrophe

Vast amounts of methane are stored as hydrates in the Arctic, in the terrestrial permafrost and as clathrate lattices in the deeper, colder layers of the ocean. Rising temperatures are currently releasing quantities of methane into the atmosphere; extreme conditions could cause hydrates to become unstable, potentially resulting in the release of huge quantities of methane, which is a significantly more powerful accelerant of climate change. In these circumstances, which have happened before, the rate of warming could lead to a runaway feedback cycle with extremely harmful, or at worst, catastrophic implications for all life on earth. The onset of this shock could be abrupt, with massive release triggered by seismic activity or simply by deep ocean mining.

Abrupt Climate Change

Abrupt climate change from a warm and wet environment to colder and drier conditions, occurring within a decade or less, has occurred several times in the past 100,000 years and even within historic memory, such as in the early 14th century in Europe. Evidence

from ice-cores indicates that the end of the last Ice Age, 12,000 years ago, which warmed the planet by 5 degrees, occurred over one decade. The Earth's population has grown exponentially in the last century and any future event of this type would have more dramatic human consequences, resulting in societal collapse, mega-migration, intensifying competition for much diminished resources and widespread conflict.

Resource

Globalized Economic Collapse

Globalization will result in critical interdependencies that will link members of a globalized society that includes a small super-rich elite and a substantial underclass of slum and subsistence dwellers, who will make up 20% of the world population in 2020. A severe pricing shock, possibly caused by an energy spike or a series of harvest failures, could trigger a domino effect involving the collapse of key international markets across a range of sectors. The impacts of this collapse could be transmitted throughout the globalized economy, possibly resulting in a breakdown of the international political system, as states attempt to respond to domestic crises and the local effects of wider economic collapse. Sophisticated societies that depend on complex, transnational networks for the supply of basic human needs, such as food that cannot be provided indigenously, are likely to face severe infrastructure failure, collapse of public services and societal conflict.

Revolution in the Supply of Energy

Investment in alternative sources of energy, particularly hydrogen power, offers the possibility of an affordable, miniaturized, autonomous power source, especially as advanced fuel cells could enable power to be stored for transport systems and other remote platforms. A sudden and early breakthrough would reduce global dependence on increasingly scarce fossil fuels and the unstable regions from which they are obtained, significantly altering the geopolitical context of the early 21st century. Similar shocks might arise from early breakthroughs in nuclear fusion and the exploitation of methanol and ethanol.

Collapse of Fish Stocks

The largest single source of protein for human beings is fish. Most of the world's major fisheries are being exploited beyond their sustainable yield and, with climate change, the sea is becoming more acidic. A global collapse in fish stocks, resulting from over fishing or climate change, would result in the economic collapse of coastal populations, social instability and widespread hunger, as well as the loss of a significant source of carbon-capture. South and East Asia, with higher than global average dependence on fish protein, would be especially severely affected.

Africa Becomes a Failed Continent

Challenges, including climate change and HIV/AIDS, scarcity of food and water and regional conflict could lead to Africa becoming a failed continent, where even large, currently self-sustaining states become chaotic. Outside engagement and intervention would effectively be limited to a small number of well-defended entry points and corridors, which would provide access to raw materials essential to the global economy. Nations or corporations wishing to trade with Africa would increasingly be required to provide security for their nationals and the necessary support to sustain critical areas of access and security

Social

New Humans

The application of advanced genetics could challenge current assumptions about human nature and existence. Initially employed for medical purposes, breakthroughs in these areas could be put to ethically questionable uses, such as the super-enhancement of human attributes, including physical strength and sensory perception. Extreme variation in attributes could arise between individuals, or where enhancement becomes a matter of fashion, between societies, creating additional reasons for conflict.

Youth Reaction

Declining youth populations in Western societies could become increasingly dissatisfied with their economically burdensome 'baby-boomer' elders, among whom much of societies' wealth would be concentrated. Resentful at a generation whose values appear to be out of step with tightening resource constraints, the young might seek a return to an order provided by more conservative values and structures. This could lead to a civic renaissance, with strict penalties for those failing to fulfil their social obligations. It might also open the way to policies which permit euthanasia as a means to reduce the burden of care for the elderly.

Genetic Treatments to Prevent the Effects of Ageing

Developments in genetics might allow treatment of the symptoms of ageing and this would result in greatly increased life expectancy for those who could afford it. The divide between those that could afford to 'buy longevity' and those that could not, could aggravate perceived global inequality. Dictatorial or despotic rulers could potentially also 'buy longevity', prolonging their regimes and international security risks.

The Middle Class Proletariat

The middle classes could become a revolutionary class, taking the role envisaged for the proletariat by Marx. The globalization of labour markets and reducing levels of national welfare provision and employment could reduce peoples' attachment to particular states. The growing gap between themselves and a small number of highly visible super-rich individuals might fuel disillusion with meritocracy, while the growing urban under-classes are likely to pose an increasing threat to social order and stability, as the burden of acquired debt and the failure of pension provision begins to bite. Faced by these twin challenges, the world's middle-classes might unite, using access to knowledge, resources and skills to shape transnational processes in their own class interest.

Terrorist Coalition of the Willing

Islamist terrorism is likely to remain the most obvious manifestation of the international terrorist threat until at least 2020. However, changes in the strategic context could cause this threat to evolve in unusual ways. A generational change among leading Islamist terrorists could lead to a more broadly based coalition of opposition to the cultural invasion caused by globalization and modernization. A terrorist coalition, including a wide range of reactionary and revolutionary rejectionists, such as ultra-nationalists, religious groupings and even extreme environmentalists, might conduct a global campaign of greater intensity.

Political

Chinese Collapse

China's economic growth will be accompanied by significant demographic changes, including the urbanization of its population, which uniquely among developing countries, is ageing. These factors, together with changing patterns of land use, the failure to deliver per capita prosperity and environmental stresses caused by climate change and pollution, could reduce China's traditional resilience to natural disaster. A future large-scale disaster might therefore cause China's progress towards strategic power status to stall and might even result in it becoming a failed state, prone to civil conflict and separatism.

Micro Government

Governments are likely to demand increased self-reliance from citizens, who will in turn expect their obligations to be reduced in proportion, possibly focusing government on its core roles of Defence, Justice and Legislation. The operation of globalized markets and communications might further weaken levels of identity between the citizen and state to a point where increasingly footloose and apolitical populations see the latter purely as the guarantor of an area of jurisdiction, the guardian of a body of law and a force of last resort.

Cities Challenge States

Successful, internationally networked cities, as engines of economic development and opportunity, could increasingly assert their independence and new found status in contrast to their backward, less developed and burdensome hinterlands. The formation of new city-states would challenge the major assumption that underpins the current international system - the sovereignty and integrity of the nation-state. Recognition of city-states' sovereignty could cause wider secession and new alignments, leading to uncertain diplomacy and a heightening of international instability.

Separatism and Secession in the US

A growing Hispanic population in the US might lead to increasing social tensions, possibly resulting in an aggressive separatist movement. Unlike the Black Power militants of the 1960s, this movement might focus on geographically-based self-determination as its aim, threatening secession by Hispanic-majority states. Confronted by this threat, the US might become increasingly introspective, withdrawing from all non-essential overseas commitments. In the wider world, other states and non-state actors could take advantage of the US withdrawal or break-up, using violence to pursue objectives that, otherwise, might have provoked a US military response.

Science and Technology

Decline in Ethical Constraints

A more permissive R&D environment could accelerate the decline of ethical constraints and restraints. The speed of technological and cultural change could overwhelm society's ability to absorb the ethical implications and to develop and apply national and international regulatory and legal controls. Such a regulatory vacuum would be reinforcing as states and commercial organizations race to develop and exploit economic, political and military advantage. The nearest approximation to an ethical framework could become a form of secular utilitarianism, in an otherwise amoral scientific culture.
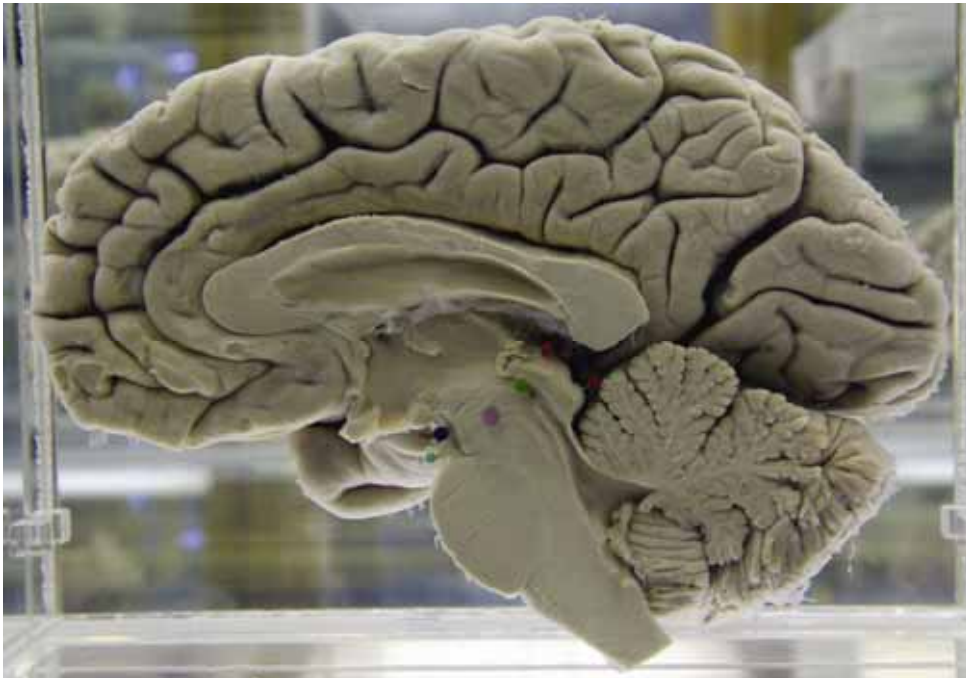
Broadcast to the Brain – Dissected Human Brain at the Museum of Neuroanatomy, University of Buffalo NY – Source: Empics.com

Broadcasts to the Brain

By 2035, an implantable information chip could be developed and wired directly to the user's brain. Information and entertainment choices would be accessible through cognition and might include synthetic sensory perception beamed direct to the user's senses. Wider related ICT developments might include the invention of synthetic telepathy, including mind-to-mind or telepathic dialogue. This type of development would have obvious military and security, as well as control, legal and ethical, implications.

Electromagnetic Pulse Use

Electromagnetic Pulse (EMP) capabilities will probably become operational during the period out to 2035. It could be used to destroy all ICT devices over selected areas, while limiting wider physical and human damage. While military and other high-value networks may be hardened against this threat, most networks and communities on which societies depend, will not. The employment of an EMP weapon against a 'World-City' (for example, an international business-service hub) would have significant impact beyond the country against which it was targeted. It might even reduce political and business confidence in globalized economic processes to the point that concern about national economic resilience reverses internationally integrative trends, leading to a world increasingly characterized by protection, control and isolationism.

Catastrophic Space System Damage

At the most serious level, space systems could be destroyed or disabled by a burst of solar energy or a natural fluctuation. Similarly, satellites and space platforms could be destroyed or damaged in a deliberate hostile attack, or by being struck by space-debris, causing a cascade of collateral damage to other space-based platforms. The damage could be amplified if an element of the chain explodes and emits an electromagnetic pulse. The consequences might include catastrophic failures of critical space-enabled utilities, triggering widespread mass-transport accidents, multiple military and public service system failures and the collapse of international financial systems.

Doomsday Scenario

Many of the concerns over the development of new technologies lie in their safety, including the potential for disastrous outcomes, planned and unplanned. For example, it is argued that nanotechnology could have detrimental impacts on the environment, genetic modification could spiral out of control and that AI could be superior to that of humans, but without the restraining effect of human social conditioning. Various doomsday scenarios arising in relation to these and other areas of development present the possibility of catastrophic impacts, ultimately including the end of the world, or at least of humanity.

Military

Globalized Inter-Communal Conflict

Economic globalization and indiscriminate migration may lead to levels of international integration that effectively bring interstate warfare to an end; however, it will also result in communities of interest at every level of society that transcend national boundaries and could resort to the use of violence. Operating within a globalized system, states might not be willing or able to regulate these groups' activities, concentrating on containing the risk and diverting their activities elsewhere according to their interests. In addition, rivalries between interest groups that cannot gain economic and information leverage might increasingly resort to violence and coercion, evolving loose arrangements and networks similar to those currently used by criminal organizations.

Chinese Power Projection

Vigorous economic growth and investment in key technologies might enable China to generate a global power projection capability before 2025. Although unlikely to match the US force-on-force in the medium term, China would nevertheless be able to deploy a significant military presence wherever its interests were considered to lie. This aspect will become increasingly evident as it seeks to safeguard stability and growth through control of commodity and energy pricing and continued access to markets. China's ability to 'pop up' with increasing frequency in areas of competing interests would present the US and others with significant strategic dilemmas, increasing the possibilities of confrontation and crisis, possibly leading to conflict.

Legal Complexity

The legal context for future conflict could become too complex for participants to be confident of compliance with international law and national responsibilities. The risk of subsequent legal challenges might be perceived to be too great by most states, inhibiting their willingness to engage in any conflict that did not involve a direct threat to their own national security or stability. This would have a significant impact on the international availability of forces for Peace Support Operations and other discretionary enterprises, leaving the field open to private or irregular forces and to those less concerned by the ethical or legal implications of their conduct.

'Magic Bullet'

In a globalized environment, military technologies will be developed at an accelerating pace, some of which might have the potential to render established capabilities obsolete. For example, a cheap, simple-to-make and easy-to-use weapon might be invented that is effective against a wide range of targets and against which established countermeasures

are ineffective. Based on civilian developments, which have become widely available this could flood the world's arms markets, from the OECD nations to the bazaars of Africa and Asia, altering perceptions about the use of force and power balances.

Explicit Use of CBRN Weapons and Devices

The use of CBRN weapons, as a regular, if sporadic, feature of the strategic landscape both by states and irregular groups would transform the basis on which military power is organised and deployed. Depending on the extent and impact of this shift, new attitudes to deterrence, containment and coercion would be required, together with a change to vulnerability-based, rather than threat-based assessments and resourcing.

Development of Neutron Weapons

The political purpose most commonly envisaged for nuclear weapons has been to deter nuclear attack by, or to offset the conventional superiority of, a potential adversary. Future concerns will centre on the potential acquisition of nuclear weapons by terrorists and other irregular entities, for coercive purposes or to inflict massive casualties. In addition, existing assumptions about the employment of nuclear weapons may be challenged in still more radical ways, including the exploration of neutron possibilities. The ability to inflict organic destruction, while leaving infrastructure intact, might make it a weapon of choice for extreme ethnic cleansing in an increasingly populated world. Alternatively, it might be considered as a basis for a new era of deterrence both in outfacing irresponsible nuclear powers and in opposing demographically strong nations.

Non-Western Perspectives

Background

Feedback from previous versions of **Strategic Trends** indicated a requirement to canvass perspectives from wider viewpoints. As a result, DCDC commissioned an extensive, web-based survey of principally non-Western views, through the agency of **LEAD International**, a non-profit organization with a global network of opinion-formers and leaders in business, government, the media, NGOs and the academic sector. Two hundred and eighty six members of the **LEAD** network from 5 regions responded to the survey and assessed levels of agreement with DCDC's Key Theme judgements. We also wanted to obtain additional insights to inform **Strategic Trends** more widely, including views on the prospects for improvement in a number of key areas of life, for example, wealth, governance and conflict.

Levels of Agreement

There was general agreement with the judgements associated with DCDC's Key Themes, with most respondents agreeing or strongly agreeing, with each of the Key Theme Outcomes. Agreement was highest with Key Theme 1, Population and Resources. Key Theme 2, Identity and Interest, while scoring lowest, still scored strongly. Similarly, there were high levels of agreement that DCDC's assessment was neither too optimistic, nor too pessimistic (76%). There was some variation in the responses from different regions, particularly on Population and Resources, especially between African and European responses, with greater agreement with DCDC's judgements from the former than the latter (86% and 63% respectively).
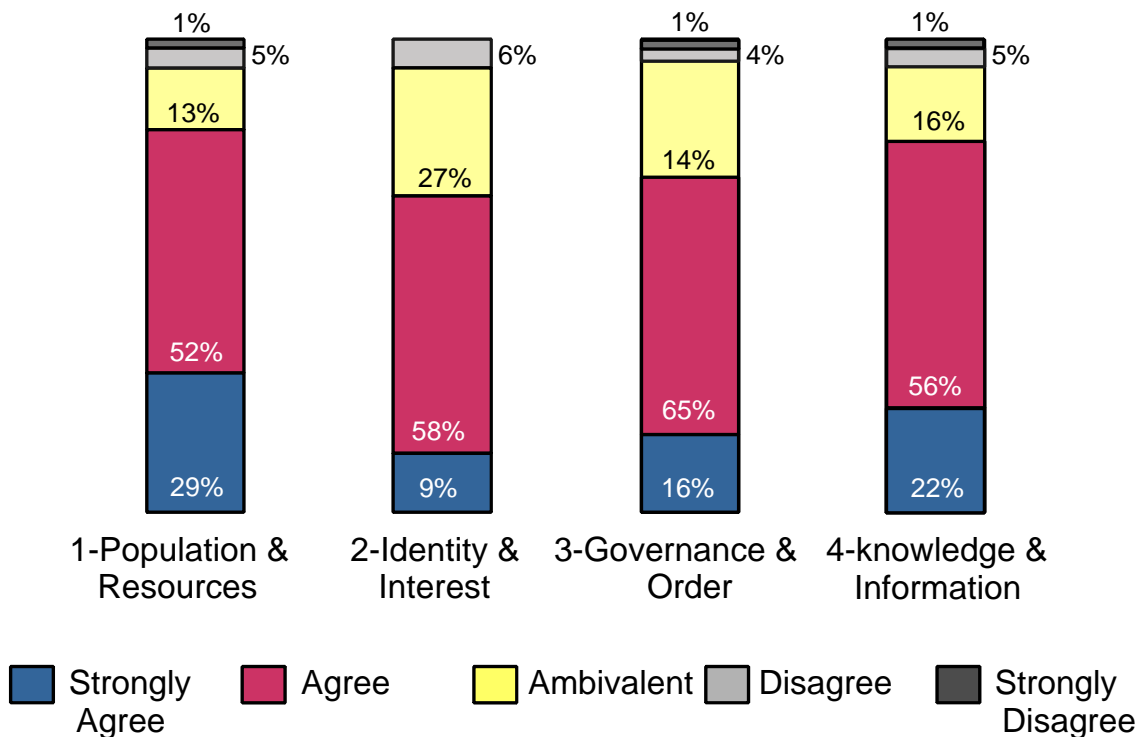
Wider Insights

One issue, the growing **disparity between haves and have-nots,** was raised in observations across different parts of the survey by a large number of respondents. The strength of opinion on this issue has reinforced DCDC's original decision to include **Global Inequality** as one of the **Strategic Trends** Ring Road issues, rather than dealing with it simply as it arises across the different sections of **Strategic Trends**. At a more detailed level, a number of respondents highlighted the need to give greater emphasis to the outcomes of **adaptation as a response to climate change**, while others highlighted the **continuing significance of religion**, in contrast to the wider trend towards secularization. These and other issues have been given greater emphasis as they arise in the **Strategic Trends Dimensions**.

Global Prospects

The final section of the survey invited consideration of whether the Key Themes and their drivers might shape the world over the next 30 years for better or worse, using key indicators such as health, education, crime and conflict. Overall, *most respondents judged that the world would be better or, at least, no worse* in future than it is today. The greatest prospects for improvement were judged to be in access to information, with definite improvements in health and education; however, there was greater ambivalence about improvements in governance and wealth. Most respondents believed that *crime and conflict would be worse*. Overall, *the balance of responses on Global Prospects accords closely with that provided by the DCDC in Strategic Trends.*

Levels of Agreement With Key Themes and Judgements

	1-Population & Resources	2-Identity & Interest	3-Governance & Order	4-knowledge & Information
Disagree (top)	1%	—	1%	1%
Disagree	5%	6%	4%	5%
Ambivalent	13%	27%	14%	16%
Agree	52%	58%	65%	56%
Strongly Agree	29%	9%	16%	22%

Legend: ■ Strongly Agree ■ Agree ■ Ambivalent ☐ Disagree ■ Strongly Disagree

Examples of Reasons given for Agreement/Disagreement		
KEY THEME	**STRONGLY AGREE/AGREE**	**DISAGREE/AMBIVALENT**
1. Population & Resources	*Conflicts will arise over uneven resource distribution and access.*	*Oversimplifies – representing developing areas as the source of threat.*
2. Identity & Interest	*The quest for opportunities and their attainment will be the yardsticks for identity.*	*The poor will tend to maintain collective identities; the rich will become more individualistic.*
3. Governance & Order	*International cooperation will be required, but not all governments will submit to international rules.*	*The most powerful country in the world turns its national interests into "international solutions".*
4. Knowledge & Innovation	*Our knowledge is quite dangerous when considered in the light of some of the previous themes and drivers.*	*If disparity of economic growth still exists, only a few fortunate countries will benefit from innovation.*

Figure 7 - LEAD Survey – Levels of Agreement/Disagreement

LEAD Survey Results: Global Prospects - Better or Worse?
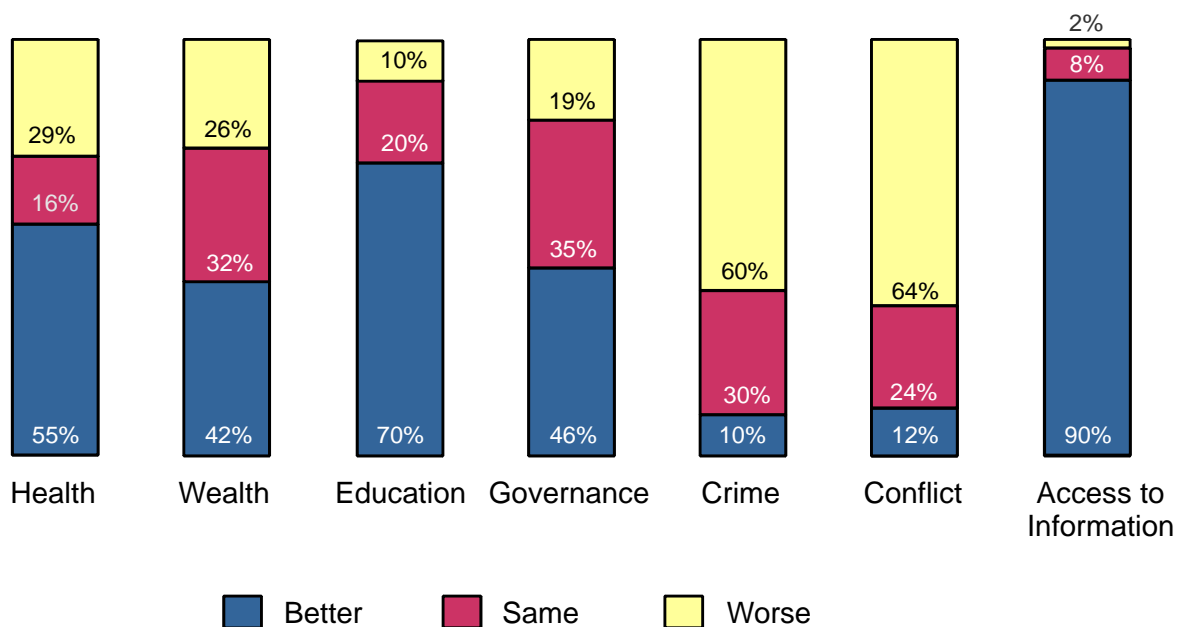
Figure 8 - LEAD Survey - Global Prospects

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