

From R&D investment to fighting power, 25 years later

Countries have been investing in defense R&D at widely differing rates—a fact that is likely to lead to significant shifts in the global military balance over the next two decades.

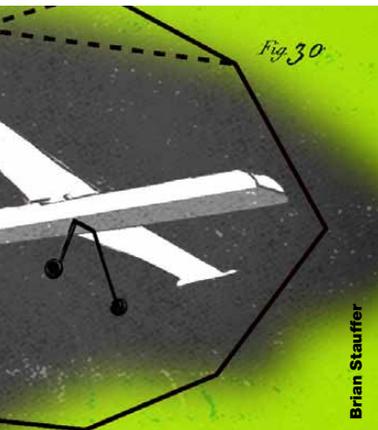
**Steven Bowns and
Scott Gebicke**

In today's constrained budgetary environments, nations are investing in defense research and development at wildly different rates. Some countries are trimming, if not slashing, their budgets, whereas others are boosting their R&D spend, trusting that their investments will pay off down the road. Yet it has never been easy to link defense R&D investment to victory on the battlefield, simply because of the slow pace of testing and adoption of substantial new combat technologies. Generally, the process of moving from lab to field takes decades.

Detailed regression analysis conducted in recent years, however, shows a statistically valid correlation between the levels of R&D investment

and the quality of a military's equipment 25 years later. The regression model uses a 25-year time lag for R&D to "pull through" into equipment deployed in the field, which is realistic judging from the development cycle times of combat technologies launched in the past few decades.

We have now used this model to study the evolution of R&D investment from eight major nations and project these nations' military equipment quality (MEQ) out to the 2030s. What emerges are a number of important shifts that governments and industry players will need to factor into their long-range strategic planning. Namely, while the United States



will maintain its MEQ dominance, the same cannot be said of Russia. The major European nations' MEQ will stagnate. The rising military powers of Asia—including China, India, and South Korea—will develop much stronger capabilities over the next 20 years, eclipsing Western European countries in military might.

As a result of these trends, governments will need to make dramatic changes in international policies with regard to the proliferation of military technology. They will also see a greater need to forge force-projection alliances in this increasingly multipolar world. European countries will need to collaborate more closely with one another. And the defense industry, which today is predominantly Western, will have to contend with both new competitors and restrictive regulations in the very markets that offer the most growth potential.

MEQ: Our key metric

Our insights stand atop important work done in 2006 for the UK Ministry of Defence. Using regression analysis, co-author Steven Bowns generated a historical conversion function of R&D investment into a quantified metric, MEQ, which compares one aspect of the fighting power of one military with the same aspect of the fighting power of another. The analysis involved using conjoint techniques to assess 69 categories of military equipment across ten countries and five time periods dating back to 1971, generating like-for-like comparisons of the equipment's fitness for purpose. This work produced expert ratings on the overall quality of 5,500 pieces of military equipment—a statistical robustness that gives MEQ much greater reliability than any other published measure of defense output to date. These ratings were then mapped against R&D spending data from 25 years before. The overall

correlation between MEQ scores and R&D investment 25 years prior came out to be 0.9—a very strong indication that, over time, governments got what they paid for.

MEQ alone, however, does not guarantee military victory. Troop quality, doctrine, leadership, morale, and other factors play important roles in combat. In addition, the changing nature of modern warfare—in which counterinsurgency efforts and special-forces teams are as prominent as traditional tanks and artillery—would seem to complicate the value of MEQ as an indicator. While we acknowledge the difficulty of analyzing current conflicts, we nevertheless believe that MEQ, if coupled with a measure of troop quality, could well predict the outcome of future wars.

The shifting military balance

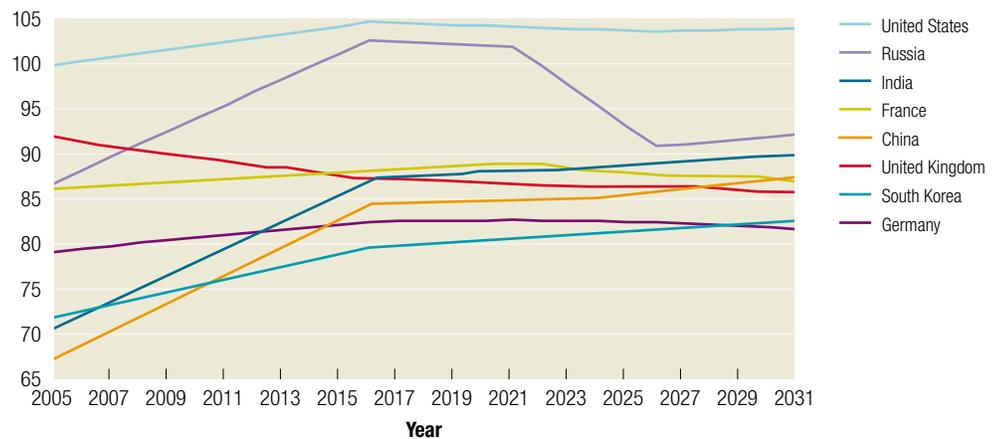
In today's world, substantial shifts in military R&D investment are occurring—shifts that have serious implications for the global defense landscape. We applied the MEQ function to recent R&D spending data drawn from eight countries: Europe's three largest R&D spenders, the United Kingdom, France, and Germany; rising Asian powers China, India, and South Korea; and the long-time R&D spending champions, the United States and Russia, as benchmarks. Our analysis sheds light on an important military technology question: when, if ever, will Asian nations overtake the Western powers? We studied R&D investment levels through 2006 to derive future MEQ scores until 2031 (Exhibit 1).

Our model obviously cannot account for exogenous disruptions such as technological innovations or economic turmoil—thus the imperfect 0.9 correlation. With this limitation in mind, what does this forecasting exercise tell us about the military equipment landscape in the 2030s?

Exhibit 1

Military equipment quality

The US will stay dominant; Asian powers will achieve parity with Europe.



Source: Technology Futures

American edge endures, Russia struggles

The Cold War spending boom and bust still drive a large share of equipment quality, even decades later. The United States remains the dominant force, and perhaps the most striking feature of American MEQ supremacy is that even by 2031, no nation has significantly closed the gap with—let alone overtaken—the United States. The steady rise in the US's MEQ results from the increases in military R&D spending in the late 1980s under the Reagan administration. Spending declined in the 1990s, but climbed again following the attacks of September 11, 2001.

The rise and subsequent fall in Russia's MEQ result directly from the large increase in Russian R&D spending in response to the Reagan defense buildup, then the sharp drop-off after the collapse of the Soviet Union. Whether we will see an effective conversion of Gorbachev-era R&D into real equipment in service remains to be seen; the Russian machinery for pulling through military R&D to the field may well be broken. If that turns out to be the case, the expected near-term upsurge in Russian MEQ might not materialize and the falloff after 2015 might be much more dramatic.

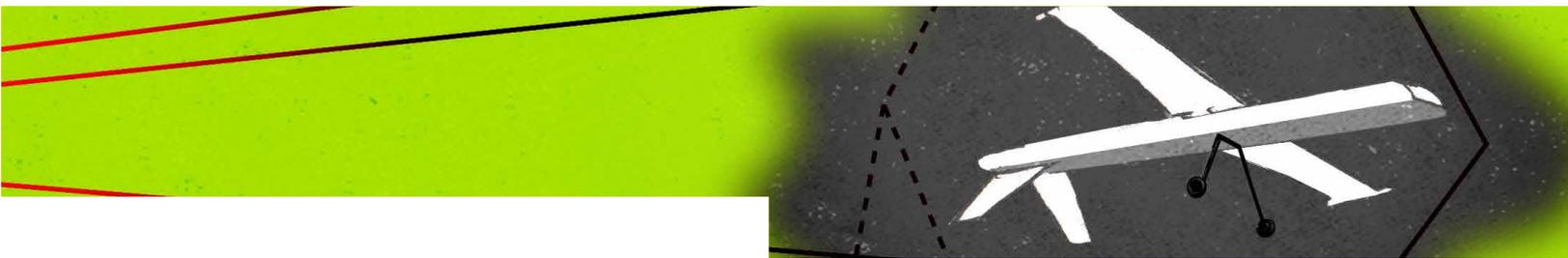
The East rises

R&D investment trends across Asia over the past decade have led us to believe that China, South Korea, and India will see dramatic surges in MEQ over the next ten years. We see these Asian powers overtaking European countries during the next two decades.

Our model may be exaggerating the effect of this growth, as there are certain line items baked into Asian countries' defense budgets that make true comparisons difficult. (For example, the defense budget data for India include program-specific surges.) South Korea is a special case, in that it has historically been a preferred recipient of US technology transfer, so predicting that country's future MEQ based solely on indigenous R&D spending could underestimate its ranking. In any case, the strong growth in these Asian nations' R&D investments is likely to continue for the foreseeable future (Exhibit 2).

Europe risks falling behind

Unlike the roaring tigers of Asia, Europe can expect its MEQ rankings to plateau—or even decline—based on recent reductions in R&D investment. The UK decline stems from



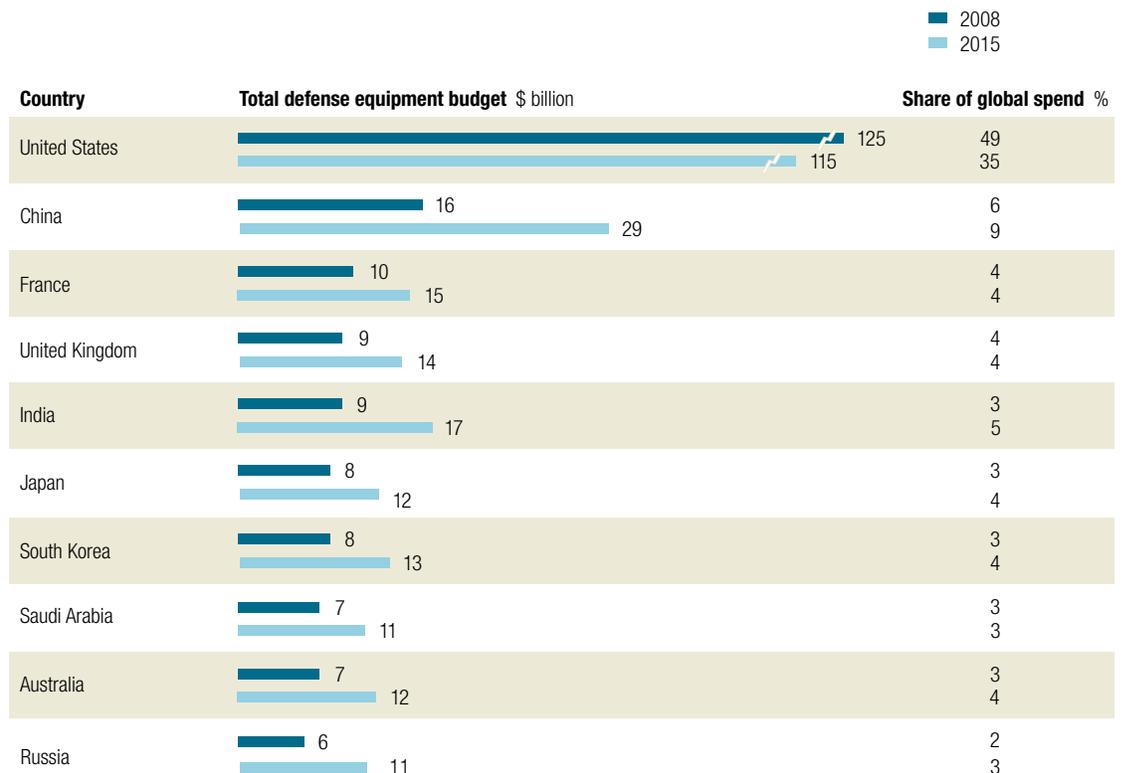
progressive cuts in R&D starting in the mid-1990s as the United Kingdom took a large post-Cold War peace dividend. Further cuts continue, with some coming as recently as September 2009, when the UK Ministry of Defence announced a 25 percent cut in its research budget. France is in a slightly different position, as it took a smaller peace

dividend in the 1990s and has since seen some increases in R&D spending. Even so, India is still likely to overtake France in the mid-2020s (Exhibit 3). Germany, a nation that tends to spend comparatively small sums on military R&D, will fall behind India by 2012 and behind the other Asian powers soon thereafter.

Exhibit 2

Defense equipment spending

There is strong growth in Asian nations' investments.



Source: *The Military Balance 2009*, International Institute for Strategic Studies

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What remains unclear is whether further consolidation among Europe's indigenous defense industries will occur. Such consolidation may improve European countries' ability to pull R&D investment through to the field.

Implications for defense ministries and industry

These conclusions, some less surprising than others, have complex implications for how governments and players in the defense industry ought to plan for the future. Assuming MEQ is indeed a dominant predictor of behavior, four main implications emerge.

Policy changes in response to increased regionality

The rising Asian powers may focus their investments on equipment that will allow them to project military force far from their shores. An example of this might be the transition of China's navy to more of a "blue-water" orientation. China already has aircraft carriers, amphibious assault ships, and fleet train vessels in its acquisition pipeline; its possession of such platforms could lead to an increased propensity to intervene in regional conflicts. This risk is especially acute in areas of resource disputes such as those around the Pacific Rim and the Indian Ocean, which were previously beyond China's reach because of a lack of long-range force-projection equipment. China's ownership of such equipment will also raise the cost of intervention for powers from outside the region. Governments must plan for this increased regionality and multipolar force projection—a mammoth strategic task.

Evolving proliferation policies

The ultimate direction of weapons proliferation in Asia will be shaped by Chinese policy decisions. If China continues to export advanced combat

technology to countries in Asia, Africa, and the Middle East, and if China produces innovations that radically improve its military hardware, the results could include widespread proliferation and an unexpected MEQ catch-up effect for a variety of developing nations.

While American MEQ dominance looks reasonably secure, the United States will need to decide whether to keep high-tech weapons proliferation on the diplomatic docket, particularly as the United States and China do not currently see eye-to-eye on the topic. Proliferation could become a more important factor in Sino-American relations in the future. The outcome of such talks could also affect military sales and technology transfer decisions in other regions, such as Africa or Latin America, which may then require additional policy shifts among the major powers.

Need for pan-European collaboration

As Europe's individual member states continue to reduce their military R&D spending, the region as a whole stands to see its edge in MEQ erode dramatically. This prediction, however, reflects the current industry structure, which features only nascent collaboration among European governments.

Increased collaboration among governments and further consolidation in the European defense industry could help Europe maintain some advantage over the Asian powers. Given the success of existing multinational European ventures, such as missile developer MBDA, and the region's common currency, pan-European collaboration appears to be a promising route. But there seems to be little political will emerging to carry this through. Will the increasing threats posed by the catch-up of the rising East supply this political will? It seems unlikely at present.

Exhibit 3

Realizing advantage

Asian powers are poised to overtake Western countries in the next 20 years.

**Discontinuity in the defense industry**

Many Western original equipment manufacturers (OEMs) have already established a presence in Asian markets. However, this dynamic is fragile, as emerging markets tend to be far more demanding today than they were in the past when it comes to technology transfer and local production. Strict regulations and the rise of former partners turned competitors mean Western OEMs risk becoming obsolete in Asia's growth markets—a risk further exacerbated by Western governments' tighter export control laws. This trend has played out in adjacent industries—shipbuilding and high-tech assembly, for example—with dramatic restructuring effects. The defense industry will need to find ways to manage this discontinuity.



The military balance of the 2030s is unlikely to resemble today's. We see the rising Eastern powers resorting more often to regional conflicts, in the knowledge that a dispute could be fought out to a conclusion without US intervention. And while the United States should retain a

significant MEQ advantage, intervention in conflicts in other parts of the globe is likely to become much riskier, even for a superpower. Unless Europe brings together its R&D efforts into a more unified construct, it will risk falling behind Asia—and could thus become highly reluctant or even unable to intervene in any conflict without being part of a coalition led by the United States. In light of these trends, governments and the defense industry must become more flexible and resilient so as to meet the coming challenges and respond to changing market dynamics. ○