



Air Force crews perform preflight checks as B-1 Lancer flies overhead during operational readiness exercise at Ellsworth Air Force Base (U.S. Air Force/Zachary Hada)

# Airpower and Globalization Effects

## Rethinking the Five Rings

By Michael W. Pietrucha

In 1988 Colonel John Warden, USAF, developed the “Five Rings” model, classifying a country as a system organized into five rings. Given traction in the Gulf War, the model has been a staple of airpower advocacy for

two decades. The theory advocated airpower as a force that could bypass the outermost ring to achieve effects against the others, presumably with a decisive effect. But this model, which seemed perfect for Middle East autoc-

racies, seems less applicable against modern peer competitors. What happens to the theory when the exploitable vulnerability is in another ring?

Two decades later, it seems that the interconnected web of international trade has changed the effects of certain warfighting strategies, rendering an integrated economy vulnerable to infrastructure (third ring) attacks. This target set is particularly attractive because in a globalized economy, the transport of materials and goods is a chain that lies partially outside the protection provided by the fifth ring. Nowhere is this more apparent than in the realm of maritime transportation, particularly in the Indo-Pacific region.

The implications for military strategy are profound. For the United States, it means that the force-on-force challenge of using advanced penetrating systems

---

Colonel Michael W. Pietrucha, USAFR, is the Individual Mobilization Augmentee to Pacific Air Forces.

in the teeth of an advanced integrated air defense system may not be necessary. It also means that the characteristics of air forces, namely their speed, range, and flexibility, are well suited to an interdiction strategy intended to deprive a country of the materials needed to sustain day-to-day operations. It is time to reexamine the strategy assumptions that have served as the foundation for air campaign planning in the region.

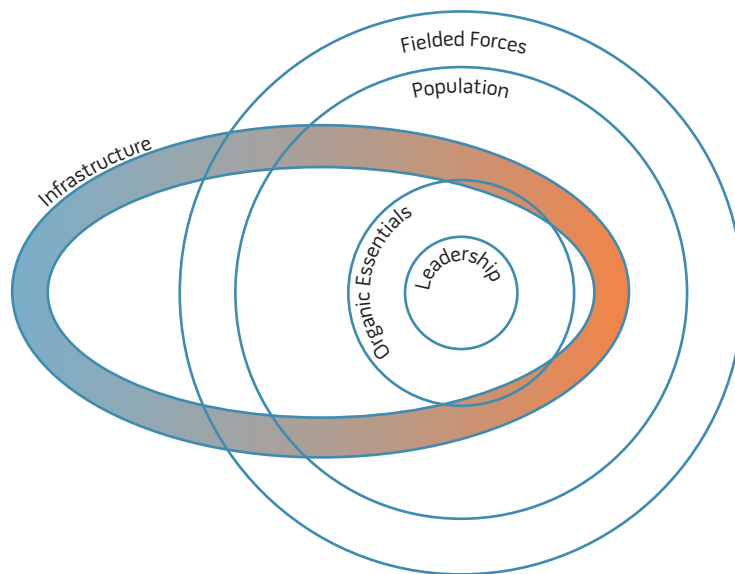
## Overview

With the pivot to the Pacific, the United States is staking its position as the primary exporter of Pacific stability. As a Pacific nation, it maintains a position as an explicit guarantor of freedom of access to the global commons. Accordingly, Washington faces several nations who understandably have differing foreign policy goals in a context that is rife with historical enmities, territorial disputes, and competition for resources, much like any other region of the world. The key difference lies in one overwhelming geographic factor: this region is greatly shaped by water and the lines of communication and commerce that overlay the maritime domain. Because of the geography of Asia, international road and rail links are inferior to maritime links for international transport and sometimes even for domestic movement. It might be overstating the case to assert that those transportation links are inherently fragile, but some are vulnerable to interdiction. The strategy is referred to here as *strategic interdiction*, a joint mission designed to prevent the movement of resources related to military forces or operations.

In figure 1, the Five Ring model is altered, keeping the view of a country as a system but changing the concentric structure of the rings because the transportation portion of the infrastructure has expanded globally beyond the protection of fielded forces.

The Indo-Asia Pacific theater is largely maritime, and goods and energy travel mainly by sea. Certain countries are completely dependent on maritime traffic for international movement of

Figure 1. Altered Five Ring Model



economic essentials that cannot be sourced domestically. In 2011 Asia and Oceania accounted for 51 percent of the world's maritime cargoes loaded and 56 percent of the cargoes offloaded, dwarfing Europe at 19 percent and 23 percent, respectively.<sup>1</sup> Accordingly, any Pacific strategic interdiction will have a significant maritime interdiction component.

## Relevant Air Force History

For the United States, the application of airpower against ships got off to a rocky start. Brigadier General Billy Mitchell participated in Project B in 1921, examining the effectiveness of bomber aircraft against warships. American planes sank two captured German vessels, followed by the much-heralded sinking of the battleship *Ostfriesland*. In 1923 Mitchell's bombers sank USS *Alabama*, *New Jersey*, and *Virginia*, conclusively demonstrating that aircraft could find, attack, and sink modern capital ships. Nevertheless, Pacific Fleet War Plan Orange exercises remained focused on the line of battle, failing to foresee that the airplane would define naval warfare in the Pacific.

World War II in the Pacific forever established the reach and lethality of airpower in the maritime domain as U.S. Army Air Force (USAAF) aircraft alone sank more than a million tons of

shipping. Some 310 vessels (including 70 warships) went down due to the planes. Mines laid by the USAAF accounted for 257 vessels totaling 580,000 tons sunk, 36 times the number of ships sunk by mines laid by all other sources combined.<sup>2</sup> Navy and Marine Corps aircraft, mostly carrier-based, accounted for or assisted with another 653 ships. While submarines sank the vast majority of Japanese merchant vessels, aircraft counted for the majority of warships. Maritime interdiction was recognized as an air mission by the end of World War II.

In Korea the U.S. Navy successfully blockaded both North Korean coasts, preventing hostile naval forces from affecting the conflict. In 1972 the United States embarked on a mining campaign designed to shut off the flow of seaborne supplies to North Vietnam, totaling 80 percent of all war material and 100 percent of oil imports. The mining of Vietnamese ports, following efforts at river mining, was a key element of the endgame maneuvering that ended American participation in the war.

By 1975 the B-52 was the premier Air Force maritime interdiction asset. Capable of carrying large numbers of mines derived from Mk-82/83/84 bomb bodies, the B-52 also carried the AGM-84D Harpoon, a ship-killing weapon that could be employed against

**Table. Removal of Japanese Merchant Marine by Mode of Attack**

Mode of Attack	%
Submarines	54.7
Carrier-based aircraft	16.3
USAAF aircraft	10.2
Mines (mostly delivered by B-29)	9.3
Land-based Navy and Marine Corps aircraft	4.3
Naval gunfire	1
Maritime accident/mishap	4

Soviet ships from standoff positions. The B-52 remains the primary aerial mine-layer, supplemented today by the B-1B and B-2A, although its standoff antiship missile capabilities have atrophied. With the focus on Iraq and Afghanistan, there was no constituency for retaining antiship weapons, and the capability of employing the Harpoon was allowed to slip away.

### Case Study: Japan in World War II

The effects of interdiction were illustrated in the Pacific during World War II. Japan entered the conflict with in excess of 6 million tons of shipping over 500 tons displacement; another 4.1 million tons were built, captured, or otherwise taken into service.<sup>3</sup> Japan's Merchant Marine was *the* essential support pillar for its industry and for supporting the conquest of the Western Pacific.

Occupied Manchuria and China helped supply raw materials over short distances, namely coking coal, iron ore, foodstuffs, and salt. Unfortunately, oil, rubber, bauxite, and manganese were no closer than the Dutch East Indies and the United States. In 1941 the Japanese had stockpiled a 7-month supply of bauxite and 43 million barrels of oil, which turned out to be grossly insufficient:<sup>4</sup>

*Japan's merchant shipping fleet was not only a key link in the logistical support of her armed forces in the field, but also a vital link in her economic structure. It was the sole element of this basic structure which was vulnerable to direct attack throughout a major portion of the war.*<sup>5</sup>

The U.S. campaign against Japanese shipping began 6 hours after Pearl

Harbor when the Chief of Naval Operations authorized unrestricted submarine warfare, making the submarine initiative the only interdiction effort lasting the entire war. Carrier- and land-based aircraft pitched in soon after. In the Southwest Pacific, interdiction of Japanese naval supply lines was *the* primary mission for the bomber force, and General George Kenney's 5<sup>th</sup> Air Force developed light bombers as "commerce destroyer" aircraft, introducing skip bombing to the USAAF. This proved decisive in the Battle of the Bismarck Sea, when land-based airpower decimated a major troop convoy headed for New Guinea, losing merely four aircraft.

Called "starvation" missions, aerial mining of Japanese home waters commenced in March 1945 and was directed at the Shimonoseki Strait, the key remaining chokepoint in the Japanese maritime supply network.<sup>6</sup> The effort pinned down warships and merchant vessels of all sizes. Despite the short duration, aerial mining accounted for almost as many ships damaged as all USAAF land-based air during the entire war:

*The 313<sup>th</sup> Wing got into the game late, operating with mines for only four and one-half months and at a period when the enemy's merchant fleet had contracted in size and in scope of its activities. During that short period, mines planted by the wing were more destructive than any other weapon, accounting for about half of the total tonnage disposed of. To accomplish this task, the 313<sup>th</sup> sent out 1,528 sorties and planted 12,053 mines, a much heavier effort than had been suggested by the Navy in the negotiations of 1944 and, indeed, the heaviest aerial mining campaign ever waged.*<sup>7</sup>

Japan's diversion of its Merchant Marine to support military operations, when combined with interdiction efforts, had a staggering effect on the Japanese economy as early as 1942, when submarine attacks forced the Japanese to resort to convoys. After September 1943, 72 percent of the petroleum shipped from the southern regions was interdicted, and the average rose to 91 percent after June 1944. In 1945 not a single ton of sugar or raw rubber got through.<sup>8</sup> Japanese positions across the Pacific were abandoned as the garrisons could neither be supplied nor evacuated. The effects of isolating the enemy maritime effort into small, disconnected bubbles deprived the Japanese navy of effective interior lines and the air force of the ability to patrol and defend. The strategic bombing campaign may have been the icing on the cake. The postwar Airpower Survey recognized as much:

*It is the opinion of the Survey that by August 1945, even without direct air attack on her cities and industries, the over-all level of Japanese war production would have declined below the peak levels of 1944 by 40 to 50 percent solely as a result of the interdiction of overseas imports.*<sup>9</sup>

Of the total "large" (< 500 tons) Japanese Merchant Marine referenced earlier, 8.9 million tons were sunk or removed from use by the end of the War, as seen in the table.

### Key Lessons

Four key lessons from World War II in the Pacific are applicable today:

- Maritime interdiction not only affects supplies coming to an adversary but it also affects export and power projection. Imperial Japanese garrisons on Pacific islands were isolated while the forces on the Chinese mainland and Korea were not.
- The approach was an asymmetric strategy for Washington both financially and operationally. The United States was immune to a reciprocal campaign, and the resources employed dwarfed the resources destroyed.<sup>10</sup>

- The vast majority of the interdiction efforts occurred outside the effective range of Japanese defenses. Typically, only the destination ports can be defended, and even escorted vessels travel a long, dangerous path to get there.
- This form of warfare is effective against an industrialized nation and the potential effects will be felt soonest by a well-integrated economy.

Pacific nations, unlike those in North America and Europe, are vulnerable to the disruption of maritime traffic and less able to guarantee favorable conditions on the high seas.

### Current Implications

The geographic complexity of the Western Pacific is of key importance. Shipping routes to East Asia are constrained and long archipelagos provide a barrier to sea transportation even under ideal conditions. Like the Suez and Panama canals, the Malacca Straits are a limited capacity passage through otherwise impassible terrain that can be effectively interdicted. Alternative routes add time and distance, with additional complications. Deep-draft vessels that cannot pass through Malacca must pass sequentially through the Lombok Strait, Makassar Strait, Sibutu Passage, and Mindoro Strait, a route of 1,300 nautical miles from south to north. With these passages subject to interdiction, the only alternative is to swing around New Guinea and east of the Philippines. From the east, the vast majority of Asia-bound shipping passes between the Aleutians and Hawaii and must pass through the first or second island chains.

For the United States, these conditions are a blueprint for a strategy that can both serve as an effective deterrent and as a means to coerce an aggressor should deterrence fail. While the likelihood of a U.S. conflict with the People's Republic of China (PRC) seems remote, China provides fertile ground for comparison to Imperial Japan. The country is heavily industrialized, has a large and



USS *Fitzgerald* and USS *McCampbell* maneuver with People's Liberation Army Navy destroyer *Guangzhou* off coast of North Sulawesi, Indonesia (U.S. Navy/Ian Schoeneber)

productive population, maintains a rough technological parity with its Western counterparts, and maintains a significant maritime presence. It has a modernized military with some limited ability to project power. Unlike Japan, it is a major land power and produces more of its own requirements for raw materials, fuels, and food.

The vast majority of seaborne imports come from well outside the capability of the People's Liberation Army or People's Liberation Army Navy to effectively project power. Unlike Japan and South Korea, which could reasonably expect to maintain northern supply routes to Alaska against Chinese opposition, the Chinese have no such geographical advantage or supporting structure. The country imports a massive amount of raw materials by sea, most notably bauxite and iron ore, which drive heavy manufacturing. China is also a major energy importer, which opens up a significant vulnerability.

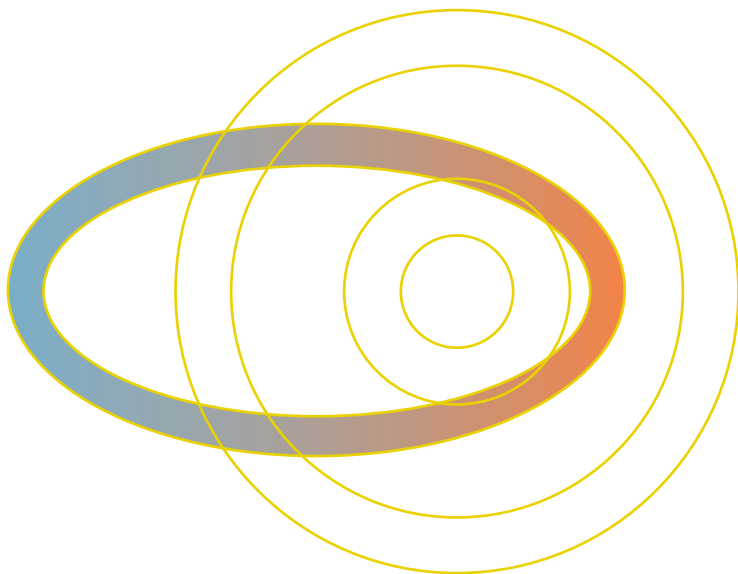
### Energy: The Sixth Ring—Sort Of

Returning to the Five Rings model, it is obvious that it is simple and changes by country. Some countries may not have

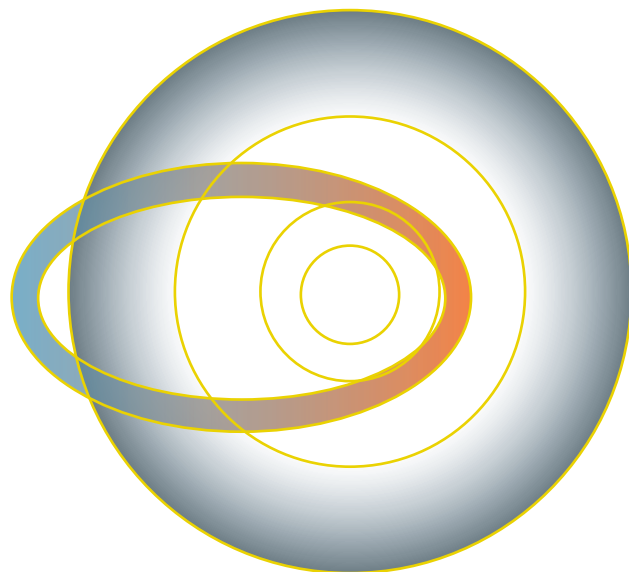
a second ring worth mentioning, the third ring may be rudimentary, the fifth ring irregular, and the first ring tribal or fragmentary. There may be significant overlaps between rings or ring relationships that blend. As shown earlier, a globalized country could have an oval third ring crossing outside the protection of the outer ring. For an industrialized nation, energy may be a sixth element in the model. The original Five Rings model considered energy and fuel as a second ring “organic essential.” Here, the sixth ring is really the energy production of a modern country including electrical and motive power and the fuel and infrastructure required to extract, transport, refine, and burn it. Instead the modified model steals energy from the second ring and transmission infrastructure from the third ring, combining them into a single item and spreading it out. Since it is not really a ring at all, it becomes a connecting layer—the glue that both holds the individual rings together and makes enduring connections among the rings (see figure 2).

There is one more change to the model, intended to represent the power projection capability of the fielded forces.

**Figure 2. Sixth Ring as Energy Production**



**Figure 3. Power Projection Capability of Fielded Forces**



Here, the outermost ring becomes like a planetary atmosphere, thinning out the farther away it gets and illustrating the difficulty of applying military power at a distance (see figure 3).

Consumption and distribution of energy change during wartime. While each of the rings is also affected by a transition from peacetime to war, the shift in energy usage by a modern military is substantial and literally instantaneous. While transportation is the foundation for shifting

forces internally, energy is the major limiting factor for force projection. In the event of a conflict, the energy ring is likely disrupted from its peacetime state even if it is a planned disruption. A country's energy production and distribution, moved from their steady state, are vulnerable to further disruption by a prepared adversary.

### **Case Study II: PRC**

China is the single largest consumer of energy in the world, deriving energy

production from a number of sources, and a net importer of fossil fuels. The combination of its large size, high consumption, and limited energy related infrastructure makes the PRC an excellent case study.

**Coal.** Coal accounts for roughly 70 percent of China's total energy production and 65 percent of its electricity production.<sup>11</sup> The PRC is the world's largest producer of coal and its largest consumer, relying on imported coal for 7 percent of its energy requirements in 2012.<sup>12</sup> Steam coal is used for power generation and coking coal for industrial processes. Well over three-quarters of the energy produced goes to support commercial enterprises, especially industry. Some 70 percent of China's coal reserves and the majority of actual coal production are located in Shanxi Province, Shaanxi Province, and Inner Mongolia. Coal consumption is concentrated along the eastern and southern coastlines in the areas of highest population density. Thus, coal must be moved relatively long distances by road, rail, and both inland and coastal waters for a distance that has been steadily increasing even as the capacity to transport it has grown.<sup>13</sup>

**Coal Transportation.** Around 2005, the capacity of the railway system to move coal was exceeded, and the demand for coal transport has surpassed even new rail construction, and this condition is unlikely to change. In contrast to the capacity-limited rail lines, port capacity to handle coal has grown markedly. China currently has 24 coal terminals for offloading and loading coal. Most are adjacent to rail facilities, indicating that even coal shipped over water relies on rail transport at both ends.<sup>14</sup>

Over the past decade, Chinese coal movements shifted from a rail-only enterprise until more than a third of the country's domestic coal was transported via water for some of its route in 2010. Coal consumed in the northern coastal areas is supplied by a network of truck routes and railways, a method that is both insufficient and prohibitively expensive for serving the southeast. Instead rail lines move the coal to ports such as Qinhuangdao, Huanghua, and Rizao

for transport by sea.<sup>15</sup> The rail lines are the main method for moving coal from Shanxi and Shaanxi provinces, and all 15 that cross provincial boundaries to the east and south rely on tunnels to get through the mountains. Accordingly, each line can be interdicted at a single point.

Most of the coastal traffic originates in the north and travels south from the Bohai Sea. This flow shows a steady increase and will continue to climb because the railways have little ability to add coal-carrying capacity.<sup>16</sup> Riverine transport is also growing, particularly along the Yangtze. Road transport is inefficient and equally subject to transportation bottlenecks. Coal shortages have become common since 2008, not for lack of coal but because it could not be moved where it was needed. For the foreseeable future, China's land-based coal distribution network will routinely operate at full capacity, magnifying the effect of any disruption. Notably, much of China's railroad transport is electric, which relies on energy produced by coal, which must be moved by the railways.

**Oil.** As coal drives electricity production, oil drives transportation. The two are not interchangeable. Coal cannot be used for transport, and oil only provides 19 percent of China's electricity production. The PRC is the second largest consumer and importer of oil, behind the United States, and its share is increasing rapidly, accounting for almost 40 percent of the worldwide growth in oil demand. In 2011 it imported over 5 million barrels of crude oil per day, accounting for 54 percent of its total demand. Only 10 percent of oil imports came overland<sup>17</sup> while more than 50 percent came from the Middle East. Half of China's total oil consumption comes by sea. There are only two oil pipelines for importing crude oil, one stretching through Siberia and terminating at the Daqing refinery and the other extending from the Caspian Sea coast in Kazakhstan to the refinery in Dushanzi. The total pipeline flow is roughly 800,000 barrels a day (bbl/day).

China is making an effort to establish a strategic petroleum reserve. In 2010 it had a commercial storage capacity



Office of Naval Research head of C4ISR explains suite of information technology tools (U.S. Navy/ John Williams)

of between 170 and 310 million barrels but no national strategic reserve. The 10<sup>th</sup> 5-Year Plan (2000–2005) marked the beginning of the government strategic petroleum reserve (SPR) program, planned in three phases. Phase 1 established a capacity of 103 million barrels at four sites; phase 2 (wrapping up) should expand that capacity to 315 million barrels at eight locations; phase 3, to be completed in 2020, should bring the SPR capacity to half a billion barrels. The SPR is for crude oil and not refined products, which are entirely reliant on a commercial storage capacity estimated at 400 million barrels for all types of refined fuel combined.<sup>18</sup>

Crude oil must be refined before it can be burned, and China does not have the domestic refinery capacity for its refined fuel requirements. For example, the PRC does not refine jet fuel domestically in sufficient quantities. In 2010 it produced 261,000 bbl/day while consuming 348,000 bbl/day, an imbalance that has steadily worsened since 2004.<sup>19</sup> In the past decade Beijing has undertaken an ambitious effort to increase refining activity. While capacity will increase to about 14 million bbl/day by 2015 (from < 6 million bbl/day in 2000), refinery operations are being consolidated into fewer refineries of much greater size.<sup>20</sup> Wartime jet fuel demand will rise well above

peacetime levels even if civilian consumption is much reduced.

**Oil Terminals.** China has many ports including 7 of the 10 largest in the world.<sup>21</sup> Both oil and coal require highly specialized offloading and storage facilities, and China's oil import data from 2010 shows that of its top 20 oil terminals, 10 are large (offloading more than 20 million tons a year) and 10 are medium (offloading 8–20 million tons a year).<sup>22</sup> Only two of the large and four of the medium oil terminals are adjacent to the South China Sea. Those ports accounted for only 20 percent of the total offload; the vast majority of this oil was offloaded in the ports that are farthest up the coast. The major terminals at Nanjing and Shanghai and the medium terminals of Yangpu and Nantong are all Yangtze River terminals, together accounting for 14 percent of the 2010 offload from the terminals.

**Energy Vulnerability and Strategic Interdiction.** The vulnerability of a large industrialized economy to energy disruption is inarguable, but a strategic interdiction campaign will not be quick or easy. Targeting the sixth ring would take a campaign-level effort against a widely distributed target set. It is the wide distribution that makes this a particularly difficult problem for a defender; thousands of miles of pipelines, railways,

and sea lanes cannot all be defended by surface-based air defense systems. Similarly, coastal facilities are not deep inside defended airspace and are among the most exposed and fragile elements of a country's infrastructure. The flammability of petroleum storage and refining poses difficulty even in peacetime. Refineries are also subject to single points of failure due to the nature of the refining process.

The conduct of a strategic interdiction campaign requires a modern military but puts a premium on the overall breadth of joint capabilities rather than a niche force designed to penetrate the worst of the air defenses. Instead it is a strategy intended to deter an enemy by posing a viable threat to critical parts of a national industrial machine that cannot easily be defended. It is essentially an indirect approach that avoids the necessity of penetrating enemy ground-based air defense and renders such an investment inherently less valuable.

The nature of the campaign can also be affected by an alliance structure and by the strategic depth of the competing sides. In this context, island bases too far away to employ aircraft against a mainland adversary serve well against distant vessels within the transportation network. Basing facilities on national territory or the territory of allied nations provides launch points for aerial surveillance, support facilities for naval vessels, and key nodes in a "web" designed to prevent certain types of vessels bound for an opposing nation from reaching their destinations.

A strategic interdiction campaign might have four elements:

- A *counterforce* strategy can be designed to attrit adversary naval forces (gray hulls) to the point where they can neither project military power nor defend against U.S. power projection.
- An *inshore* element can consist of operations to deny effective use of home waters including rivers and coastal waters.
- An *infrastructure degradation* plan could disrupt or destroy specific coastal capabilities such as oil termi-

nals, refineries, repair facilities, locks, naval bases, and loading facilities that are directly supportive of, or replacements for, adversary maritime capabilities. Not to be overlooked in this category are overland oil pipelines and rail lines.

- A *distant* anticommerce strategy could occur out of effective adversary military reach. Such a strategy might not be lethally oriented, but rather directed toward the seizure and possible internment of national-flag vessels.

A counterforce strategy might be more accurately described as a strategy to counter adversary power projection. The air defense capabilities of modern surface combatants combined with the increasing capabilities of many a submarine force will make this a battle for capable joint and combined forces. That will require a robust and effective submarine force along with an Air Force contribution that includes combat aircraft that can detect, identify, and engage vessels from standoff ranges. Removal of even a limited blue-water threat will prevent effective use of escorted convoys and remove a reciprocal counterforce strategy from the table.

An inshore strategy is extremely difficult to execute because it is conducted within reach of hostile air defenses. The use of low-observable platforms is a key enabler for this part of the strategy, and some elements of an inshore strategy cannot credibly be contemplated without penetrating air defenses one way or another. However, the payoff is worth the risk because the effects ripple out through the target country. An inshore strategy might be enhanced by the use of air or subsurface-laid minefields in areas of the coast with high volumes of maritime traffic. Mining has massive effects on seaborne movement even when no mines are actually present; merely fear of mines is an effective deterrent to movement. Given China's riverine geography, river mining could be equally effective, if harder to accomplish. In the event that a large mine actually sinks a vessel in a shipping channel, clearing the channel becomes a very difficult endeavor. We

should also not forget another set of lessons from Operation *Allied Force*: bridges dropped in major rivers are dual-purpose barriers; they both break roads or railways and block channels.

Attacks on maritime and supporting infrastructure might be conducted to further limit port capacity and reduce the ability of the adversary to turn to alternatives (however limited). Oil pipelines are effectively impossible to protect because of their length, and they typically cross the borders in areas that are undefended except by air. It is this kind of environment for which the B-2 or LRS-B might have been designed. Coal-loading facilities would be lucrative targets that might severely impede power generation in the short term while leaving the actual power generation facilities undamaged.

Last, the distant strategy is one intended to interdict energy at points far closer to the origin than the destination. It would include attack against oil pipelines and remote railway chokepoints but would focus on the maritime elements of the transportation network. The distant strategy can be conducted by a mix of forces far from hostile shores. Nations may do no more than enforce their traditional rights as neutrals and still impose an effective penalty by denying coastal routes that might ordinarily be open. Furthermore, this element of the strategy can be nonlethal; vessels can be interned rather than sunk. Internment of vessels takes those ships and crews off the seas as surely as sinking them, with the added advantages that internment can be reversed and no ecological threat is posed by an interned supertanker.

## Final Thoughts

The Five Rings are classic airpower theory, highlighting the ability to overfly the outer rings to gain effects leading to a (presumed) short and decisive war. To assume that such a strategy could be conducted against a major industrial power is to ignore the 1999 example of *Allied Force* and the development of advanced air defense capabilities. In *Desert Storm* the technological advantages accrued to the attacker, while the pace of technological

development in the wake of the U.S. victory now favors the defender. Despite that, the Air Force remains fixed in the belief that “the stealth fighter will always get through.”

Even if true, any expectation that a repeat of the *Desert Storm* model would provide a quick victory should be dropped against a modern industrialized nation. Potential adversaries, bolstered by a great deal of research and development in Russia and China, have gone to great pains to prevent a recurrence, assisted by their own geography. *Allied Force* was conducted against a small country and matched a 1999 North Atlantic Treaty Organization air force against a 1969 air defense system. It lasted 78 days and took more than 38,000 sorties, a quarter of which were strike sorties, servicing a mere 421 fixed targets. The operation was conducted with minimal air opposition from the other side of the Adriatic Sea, bringing into question the idea that a similar broad application of destructive force can have a decisive effect in a large country.

A strategic interdiction strategy is intended to address operations against large, modern countries with advanced air defense systems, but it does not rely on deep penetration into defended airspace from distant bases, a significant force structure, and a design challenge that may be insurmountable. Instead it relies on the use of capable air and naval forces to affect the parts of a country “system” that are both the most exposed and the most critical for the functioning of the system. The strategy has wide applicability for a variety of crisis conditions and is well suited to an escalatory response because it contains several options that are both nonlethal and reversible. Finally, elements of the strategy can be conducted on short notice with limited forces and undertaken from substantial distances.

The implementation of an effective, obvious strategic interdiction strategy is well suited to the U.S. Pacific Command area of responsibility and should be a Department of Defense priority. It is a historically proven model of an effective strategy that has paid dividends for the United States in the Pacific before, requires no major investment in weapons

systems, and can be conducted from long distances to significant effect. It is tailor made for achieving countrywide coercive effects against an industrialized country that is dependent on maritime trade. Perhaps best of all, it is a cost-imposing strategy for Washington to undertake against an adversary, for it pits U.S. strengths against adversary vulnerabilities in an arena where the adversary’s ability to project sufficient power to prevent it is limited. JFQ

## Notes

<sup>1</sup> United Nations, *Review of Maritime Transport 2011*, Report by the United Nations Conference on Trade and Development secretariat, New York and Geneva, 2011, available at <[http://unctad.org/en/docs/rmt2011\\_en.pdf](http://unctad.org/en/docs/rmt2011_en.pdf)>.

<sup>2</sup> Joint Army-Navy Assessment Committee, *Japanese Naval and Merchant Shipping Losses During World War II by All Causes, Summaries*, table II, available at <[www.history.navy.mil/library/online/japaneseshiploss.htm#pagevi](http://www.history.navy.mil/library/online/japaneseshiploss.htm#pagevi)>.

<sup>3</sup> Secretary of War, *United States Strategic Bombing Survey, Summary Report (Pacific War)*, “Summary Report” (Washington, DC: U.S. Government Printing Office, July 1, 1946), 12, available at <[www.anesi.com/ussbs01.htm](http://www.anesi.com/ussbs01.htm)>.

<sup>4</sup> *Ibid.*, 14.

<sup>5</sup> *Ibid.*, 13.

<sup>6</sup> Wesley Frank Craven and James Lea Cate, eds., *The Army Air Forces in World War II, Volume Five, The Pacific: Matterhorn to Nagasaki, June 1944 to August 1945* (Washington, DC: Office of Air Force History, 1983), available at <[www.afhso.af.mil/shared/media/document/AFD-101105-012.pdf](http://www.afhso.af.mil/shared/media/document/AFD-101105-012.pdf)>.

<sup>7</sup> *Ibid.*

<sup>8</sup> *Ibid.*

<sup>9</sup> *United States Strategic Bombing Survey*, 15.

<sup>10</sup> In a monograph titled *Results of the American Pacific Submarine Campaign of WWII*, Michel T. Poirier calculated that the Japanese spent \$42 for antisubmarine warfare for every dollar the U.S. Navy spent and still suffered catastrophic defeat in this arena; available at <[www.navy.mil/navydata/cno/n87/history/pac-campaign.html#N\\_8\\_](http://www.navy.mil/navydata/cno/n87/history/pac-campaign.html#N_8_)>.

<sup>11</sup> U.S. Energy Information Administration, *China 2012* (Washington, DC: U.S. Energy Information Administration, 2012).

<sup>12</sup> “China’s coal imports to maintain growth in 2013,” Xinhua News Agency, December 24, 2012, available at <[www.chinadaily.com.cn/business/2012-12/24/content\\_16056988.htm](http://www.chinadaily.com.cn/business/2012-12/24/content_16056988.htm)>.

<sup>13</sup> Kevin Jianjun Tu and Sabine Johnson-Reiser, *Understanding China’s Rising Coal*

*Imports* (Washington, DC: Carnegie Endowment for International Peace, 2012), available at <<http://carnegieendowment.org/2012/02/16/understanding-china-s-rising-coal-imports/90oh>>.

<sup>14</sup> Freeman Spogli Institute for International Studies, *Industrial Organization of the Chinese Coal Industry* (Stanford: Stanford University Press, July 22, 2011).

<sup>15</sup> Richard K. Morse and Gang He, *The World’s Greatest Coal Arbitrage: China’s Coal Import Behavior and Implications for the Global Coal Market* (Stanford: Stanford University Press, August 2010).

<sup>16</sup> *Understanding China’s Rising Coal Imports*.

<sup>17</sup> Zhou Peng, *China’s Energy Import Dependency: Status and Strategies*, College of Economics and Management & Research Center for Soft Energy Science, Nanjing University of Aeronautics and Astronautics, 2011, available at <[www.esi.nus.edu.sg/docs/event/zhou-peng.pdf](http://www.esi.nus.edu.sg/docs/event/zhou-peng.pdf)>.

<sup>18</sup> Available at <[www.eia.gov/countries/cab.cfm?fips=CH](http://www.eia.gov/countries/cab.cfm?fips=CH)>.

<sup>19</sup> Available at <[www.indexmundi.com/energy.aspx?country=cn&product=jet-fuel&graph=production+consumption](http://www.indexmundi.com/energy.aspx?country=cn&product=jet-fuel&graph=production+consumption)>.

<sup>20</sup> Available at <[www.eia.gov/countries/cab.cfm?fips=CH](http://www.eia.gov/countries/cab.cfm?fips=CH)>.

<sup>21</sup> Measured in 20-foot equivalent units of cargo handling capacity, available at <[www.marineinsight.com/marine/top-10-biggest-ports-in-the-world-in-2011/](http://www.marineinsight.com/marine/top-10-biggest-ports-in-the-world-in-2011/)>.

<sup>22</sup> Data compiled by investment report, *The Chinese Oil Sector*, available at <[www.portinvestor.com/wp-content/uploads/2012/03/The-Chinese-Oil-Port-Sector.pdf](http://www.portinvestor.com/wp-content/uploads/2012/03/The-Chinese-Oil-Port-Sector.pdf)>.