

# 潛艦與台灣國防

## Submarines and Taiwan's Defense

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把某種武力講成是嚇阻武力——暗示擁有了該特定武力就能成功地達成勸阻——將會帶來把主體與客體混淆的危險錯覺。可能的嚇阻武力是被動的客體，所要影響的對象是有知覺的、主動的主體，這個主體才能作出要不要被勸阻的選擇。

(艾德華・魯瓦克)<sup>1</sup>

*Descriptions of this or that force as deterrent, which imply that the act of dissuasion is accomplished by upkeep of a given force, entail a confusion between subject and object that can be dangerously misleading. The would-be deterrent is the passive object, and the party to be influenced is the sentient, active subject, who may or may not choose to be dissuaded.*

(Edward N. Luttwak)<sup>1</sup>

美國於四月間同意協助台灣獲得八艘柴電潛艦的決定，對於長期以來一直希望獲得更多潛艦的我國海軍而言，確實是件令人鼓舞的事。但誠如魯瓦克教授所言，

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武器裝備只是「被動的客體」，單單擁有某特定武器裝備並不必然保證就能發揮嚇阻的功效。嚇阻是：影響對方不去從事某種特定行為。<sup>2</sup>在軍事層面上，其要意在於藉由將以軍事力量「因應」對方的舉動以勸誘對方不去觸發危機、發動戰爭或戰爭升級。軍事手段不是嚇阻的唯一手段。但一旦決定使用軍事手段，只有當對造考慮到我方在軍事上會有所「因應」並且——至少部分——為了要避免因我方的在軍事上的「因應」所可能帶來的成本、風險或不確定性而放棄冒險時，這樣的嚇阻才算是有效。因此，「如何因應」是嚇阻的核心，只有它才稱得上是「嚇阻介質」。<sup>3</sup>因此，在思考採購潛艦是不是能增加我國對中國嚇阻的效度時，不能不考量到我們「要如何使用」潛艦的問題。要知道：一艘出海的潛艦所能產生的嚇阻效度絕對要大過於一艘停泊港口的潛艦；同樣的，打擊武力取向（以敵方戰鬥艦隻為目標）與打擊價值取向（以敵方商船為目標）的潛艦作戰構想兩者間也有截然不同的戰略意涵。易言之，潛艦的嚇阻效度，應視其「作戰面」的運用構想而定。

In April, the U.S. government decided to assist Taiwan in obtaining eight diesel-electric submarines (SSKs). For the ROC Navy (ROCN) who had long sought more submarines so desperately, this decision was indeed encouraging news. However, as Luttwak's admonition notes, a weapon is only a "passive object" -- merely possessing a given weapon does not necessarily perform the deterrent effects we desire. A deterrence strategy is to influence an opponent not to do what you do not want him to do.<sup>2</sup> In the military sense, its essence is to dissuade the opponent from triggering crises, initiating wars, or escalating wars by committing some military "responses" when he moves. Military means is not the only way to achieve deterrence. But once military means are committed, its deterrent effects perform only when the opponent perceives that he will encounter our military "responses" if he moves and he prefers to restrain himself from moving because of, at least partly, possible cost, risk, or uncertainty that are relating to our military "responses." Therefore, the question of "how to respond" lies at the core in a deterrence equation and only it can be qualified as deterrent.<sup>3</sup> Consequently, we can not conclude that the build-up of submarine forces will multiply our overall deterrent effect against China without also speculating the issue of "how will we use them?" We must bear in mind: the deterrent effect performed by a single submerged submarine at the open sea is always much greater than a flotilla of submarines anchored at base; and a counterforce (i.e. targeting enemy's warships) use of submarines is a different operational concept with profound strategic implications from a countervalue (i.e. targeting enemy's merchantmen) use. In other words, the deterrent effect of submarines depends on their varied "operational" concepts.

這樣的前提下，延伸出一項重要的議題：那就是潛艦作戰構想與全般軍事戰略及個別戰術間的關係，這是潛艦之所以敏感的原因。軍事戰略基於國家政策考量，通常以抽象的用語來表達；戰術受到武器性能、戰場環境與訓練水準所影響，通常極為細節。作戰面的考量是介於軍事戰略與戰術間的交匯層面，一般認為，三者間呈現靜態的金字塔狀層級架構。然而，實際上這三者間的分野很少能那麼地截然分明，它們經常是動態地相互形塑，既有由上而下（軍事戰略——作戰構想——戰術）的指導；也有由下而上（戰術——作戰構想——軍事戰略）的衝擊。而後者，有可能以戰術面上的「可能」，牽動軍事戰略的調整；也有可能因為戰術面上的「誘因」，

迫使軍事戰略乃至大戰略強加配合。與其他武器相比，潛艦在它的發展歷史上很不成比例地提供了這種「可能」或「誘因」。潛艦最重要的特點是它的匿蹤性。無論是核子動力潛艦還是柴電動力潛艦，也無論它搭載的是多彈頭潛射彈道飛彈還是傳統的魚雷，這個特點讓防守方具備有起碼的第二擊能力，這是維持嚇阻穩定性的重要指標。但同樣的，這個特點，也可能讓潛艦成為遂行戰略奇襲（第一擊）的有利工具，而且，如同第一次大戰德國在幾經猶豫後還是決定採行無限制潛艦攻擊政策一樣，<sup>4</sup>潛艦也經常是戰時飲鳩止渴的價廉手段，而這反成避免戰爭升級的障礙。潛艦——即使是傳統潛艦——常被認為是「戰略性」武器，在於「比起其他任何的海軍或其他軍種的傳統載具，一艘單獨的潛艦可以施加更大的軍事面或政治面上損害。」<sup>5</sup>正因為潛艦的運用極具政治敏感度，潛艦的作戰將比起其他海軍載具更受到政治考量的約制，即令是戰時，它們的接戰規則也常由政治領導人嚴格予以界定。<sup>6</sup>

Following from these observations, one critical issue, the relationship between varied submarine operational concepts, overall military strategy and individual tactics should be considered. This is why the submarine procurement is so sensitive. On the one hand, a military strategy, which is rooted upon grand design of national policy, is always expressed in abstract terms. On the other hand, tactics, which are affected by weapon potential, battlespace, or training, are always exceedingly detailed. Operational concepts, in the military sense, constitute the converged layer between abstract strategic levels and detailed tactical level. Traditional wisdom would have us believe that the three layers display a static system of pyramidal hierarchy. Nevertheless, in reality, the boundaries between them are never so clear-cut, but rather are dynamically shaped by each other: it can be a top-down conduct (from strategy – operation – tactics) as well as a bottom-up impact (from tactics – operation – strategy). With regards to the latter, some tactical “potentialities” can bring about rational adjustments on a strategic level while some tactical “temptations” may occasionally force a military strategy, or even a grand strategy, to act in coordination with tactical logic. Comparing other weaponry, submarines in their relatively short history disproportionately provide such “potentialities” and “temptations.” Stealth is the uppermost characteristic of submarines. No matter what they are, nuclear-powered submarines or diesel-electric submarines, and no matter what they carry, MIRV (Multiple Independent Reentry Vehicles) capable ballistic missiles or primitive torpedoes, by their stealth, the defender can probably secure a limited second-strike capability which is considered as an important indicator for maintaining deterrence stability. Nevertheless, such stealth is also the best means for submarines to achieve a strategic surprise (first strike). Furthermore, in wartime, as Germany hesitatingly decided to initiate unrestricted submarine warfare in World War I,<sup>4</sup> submarines are the cheapest way to drink sand for thirst regardless the consequence may cause, and, on the contrary, may be the obstacles to prevent from escalation. The reasons why submarines, even SSKs, are considered as “strategic” weapons can be best understood from the following statement: “a lone submarine can do more damage in both a military and a political sense than probably any other single conventional platform, naval or military.”<sup>5</sup> Since the employment of submarines is extremely politically sensitive, when compared with other naval platforms, submarines operations are more often to be bound by political considerations and their rules of engagement (ROE), even in wartime, are more strictly defined by political leaders.<sup>6</sup>

武器，平時耗資維持，戰時難以控制，是決策者必須謹記於心的。一位美國海軍戰術專家曾正確地指出：「在平時，每個戰略家必須要知道它的海軍相較於敵人的真正作戰價值，否則他將可能蒙受流血的或不流血的羞辱。……在戰時，每個戰略家也必須要知道他那在平時耗資培育的海軍之相對戰鬥價值。因為，一旦投入戰場，一支艦隊很可能在一個下午就灰飛煙滅。」<sup>7</sup>美國協助我國獲得潛艦的決定，對民心士氣固然有若干鼓舞作用，但它是否能對國家安全帶來正面的效果，還必須有更嚴肅的思考。基於在前段的論述，一個完整思考武器採購——特別是潛艦——與軍事戰略間的關係本應包括下列兩個面向：（一）特定武器的獲得透過適切的作戰構想是否會強化現有的軍事戰略；以及（二）特定武器的獲得透過適切的作戰構想能否提供一個改變現今軍事戰略的機會？而這種可能的改變是否會更好？雖然對於兩者間互動的效應是極具價值的研究，但受限於作者的才能與預期的篇幅，本文將僅就第一個面向進行簡要的分析，焦點將集中在台灣如何藉由潛艦去強化其現有的「有效嚇阻、防衛固守」的軍事戰略。

Every defense policymaker must keep in mind that weapons are expensive to maintain in peacetime and difficult to control in wartime. As an American naval tactician rightly pointed out, "In peacetime, every strategist must know the true combat worth of his navy, as compared to the enemy, or he risks deep humiliation with or without bloodshed....In wartime, every strategist must know the relative fighting value of his navy - so carefully nurtured and expensive to build and maintain in peacetime. When committed in battle, the heart of a fleet can be cut out in an afternoon."<sup>7</sup> For the morale of Taiwanese population, the American decision was indeed encouraging, but for the defense planners how to use submarine to improve our national security merits more serious meditation. Based on our arguments in the previous paragraphs, a comprehensive understanding of the relationship between a given weapon procurement (especially of submarines) and military strategy should be considered in the following two dimensions. (1) How can the procurement through proper operational concepts strengthen our existing military strategy? (2) Can the procurement through proper operational concepts offer an opportunity to adjust our military strategy? Will such an adjustment be an improvement? It would be valuable to examine the effect of the interpenetration between both dimensions. However, as this would exceed both the competence of the authors and the desired length of this essay, we will confine ourselves to a short analysis of the first dimension and focus on how Taiwan utilizes submarines to reinforce its existing military strategy of "effective deterrence and strong defense posture."

在本文中，作者認為：根據中國全面進犯台灣、有限武力使用或武力展示等諸想定，潛艦是中國以低成本達成各想定目標的有利戰具。中國在潛艦數量上的優勢與我國海運線的脆弱性，構成台灣在防禦上的難題。復因水文與科技條件，使得我海軍即令大幅強化反潛作戰能力，也只能部分解決此一難題。我國購置潛艦後，固然不能直接削弱中國的潛艦威脅，但卻能藉由將對付潛艦的難題同樣加諸於中國海軍身上，來增加中國使用武力或威脅使用武力時的成本、風險與不確定性，以增加嚇阻的效度。作者認為在危機時我國潛艦應採取預防性部署以嚇阻中國升高危機，而當戰爭無法避免時，作者認為以潛艦執行傳統的商船戰並不符效益，而是應以攻擊性與防禦性佈雷、襲擾中國出海軍艦與區域聯合反潛作戰為潛艦主要任務，以阻

卻中國海軍取得台海周邊水域的制海權。這些任務，難度較高。因此，在建立新一代潛艦兵力上，我國海軍必然須有高性能的載具與戰鬥系統、高素質的潛艦官兵、優勢的戰鬥空間知識、適切的接戰規則與——更為重要的一——完善的作戰概念。

In this essay, we argue the following: According to the scenarios of all-out invasion, limited use of force, and demonstration of force, submarines are the most advantageous platforms for China to achieve its political ends cheaply. Both the overweight of Chinese submarines in terms of quantity and the vulnerability of Taiwan's maritime traffic constitute a profound difficulty to Taiwan's defense. Furthermore, due to oceanographic and technological factors, this difficulty can only be partly solved even if Taiwan substantially increases its anti-submarine warfare (ASW) assets. The build-up of the ROCN submarine forces can not reduce the threats posed by their Chinese counterparts directly. Nevertheless, by manipulating our difficulty onto the People's Liberation Army Navy (PLAN) and aggrandizing the possible cost, risk and uncertainty if China uses force or threatens to use force, the ROCN SSKs can improve the overall deterrent effect. The authors argue that to dissuade the Chinese from further escalation, the ROCN SSKs should take on a preventive deployment in crises. If war comes, the authors believe that to conduct a traditional commerce warfare is not a cost-efficient option to employ the ROCN SSKs. Rather, in order to deny the enemy's sea control in Taiwan's vicinity, Taiwanese limited submarine assets should give priority over offensive/defensive mine-laying, intercept the PLAN vessels, and joint area ASW operation. Such missions, of course, are much harder. Thus, the ROCN will need advanced platforms and battle systems, high-quality submariners, a dominant knowledge of battlespace, proper ROE, and, most importantly, sound operational concepts in the construction of its new submarine forces.

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孫子云：「上兵伐謀，其次伐交，其次伐兵，其下攻城。」軍事武力運用的最高境界在「屈人之兵而非戰也」，一旦武力真正行使，則應「拔人之城而非攻也，毀人之國而非久也」。<sup>8</sup>中國對台的軍事戰略，概括說來，主在達成伐謀、伐交，以「非戰」達成其政治目的，藉由軍事準備與言語恫嚇，一方面針對華盛頓，嚇阻其站在台北這邊，另一方面針對台北，嚇阻其走向獨立，並脅迫其以北京的條件與中國進行統一。<sup>9</sup>但是中國的和平攻勢並不排除以武力達成統一，而且為了要使其對華盛頓或台北的（正面或負面）的強制具有可信度，中國正積極地建立足以成功達成以武力統一的軍事能力。

Sun-Tzu said "the highest realization of warfare is to attack the enemy's plans (*fa mou*); next is to attack their alliances (*fa jiao*); next to attack their army (*fa bing*); and the lowest is to attack their fortified cities (*gong cheng*)."<sup>10</sup> The consummate way to employ one's armed forces is to "subjugate other people's armies without engaging in battle (*fu zhan*)."<sup>11</sup> Once one's military forces are actually used, he should aim to "capture other people's fortified city without attacking them (*fu gong*), and destroy other people's states

without prolonged fighting (*fu jiu*).<sup>8</sup> In general, the Chinese military strategy towards Taiwan aims at *fa mou* and *fa jiao*, a means of *fu zhan* for achieving the political ends. Their military preparations and verbalized intimidation, designed to deter Washington from standing at Taipei's side on the one hand, while, on the other hand, to deter Taipei from going independence and to compel it to negotiate unification under Beijing's terms.<sup>9</sup> Nevertheless, Beijing's peaceful offensive refuses to rule out the possibility of unifying Taiwan by brute force. In addition, to make its (positive or negative) coercion against Washington or Taipei more credible, Beijing is enthusiastically establishing a military capability that can succeed in the task of a forcible unification.

軍事行動用來創造有利的談判地位。<sup>10</sup>即使當武力實際被使用時，此一基本邏輯依舊適用。無論結局如何，一場戰爭必然以雙方達成某種政治談判後結束。<sup>11</sup>一九九一年中國前總理楊尚昆在中央軍委擴大會議上就曾說過：「台灣，我們是要解放的。用什麼手段解決？無非兩種，一種是和平談判，另一種是打了較量再談判。」<sup>12</sup>當這種較量來臨時，武力使用的目標、手段、結局與當事各造的內部政治狀態將決定談判的難易、內容以及戰後的和平狀態。<sup>13</sup>基本上，若中國動武的目的（無論是在戰前或戰爭中）設定在立即與全面的征服台灣，除非台灣的軍隊迅速地被擊潰，而中國能迅速佔領台灣，否則戰事既久，流血必多，在台灣內部的同仇敵愾與外來的干預下，中國達成既定目標的代價與風險都隨之增高。而且，即使中國勉強達成「迦太基式的和平」，台灣人所留下來的記憶，將使台灣永遠成為中國的內部問題，而國際間對中國的形象，將使其至少在短期間內成為眾矢之的。因此，當戰事一久，中國勢必將為此在國際間與台灣土地上付出長期與沈重的代價。所以，「非久」將是中國全面進犯台灣的軍事指導原則。然而，如果中國動武的目標並非尋求這種絕對性解決，而旨在階段性處理時，它所能運用的軍事手段將更具彈性，可視政治上攻勢的進展調整進退。理想的方式是在流血極少的情況下，延宕軍事壓力。利用「勒索」、「有限度的保留性試探」、「壓力控制」、「既定事實」與「消耗」等等策略，<sup>14</sup>增加談判籌碼。運作台灣內部可能有的紛爭，並反藉美國可能有的懼怕，來迫使台灣讓步。在這種想定中，中國的軍事壓力的強度可能從高密度的軍事演習、圍而不攻到有限度的攻擊。而一旦攻擊，或許目標僅限於台灣的軍隊與軍事設備，但其終極目的仍然是讓台灣在錯亂中自行瓦解防衛的意志。在這種想定中，並不以擊潰台灣的軍隊為必要，台灣與第三國的抵抗意志才是打擊目標。此時，「非攻」將是中國利用有限度軍事衝突時武力的最佳運用型態。

Military moves should be designed to create a favorable bargaining position.<sup>10</sup> Such a fundamental logic is still valid even when military force is actually used. Regardless of the outcome, the ending of a war inevitably involves some kind of political agreement between both parties.<sup>11</sup> As Chinese former President Yang Shangkun said at the 1991 Central Military Commission Meeting, "Taiwan, we want to liberate at any rate. What kinds of means should be used? Simply two: one is a peaceful negotiation; another is a negotiation after the contest of fighting."<sup>12</sup> When the contest comes, the aim of using force, its means and consequence, and, above all, the domestic political struggle within each party involved will largely determine the difficulties and contents of the negotiation – and the status of peace that follows.<sup>13</sup> Basically, if China aims, before or during the conflict, at the immediate and complete conquest of Taiwan, it is going to be a prolonged

and bloody war, unless the People's Liberation Army (PLA) can disarm Taiwanese armed forces and occupy Taiwan very quickly. Such a prolonged and bloody war would breed common hatred in Taiwan and possible interventions from the outside, the costs and risks that China has to bear for achieving such an aim will consequentially increase. China may manage to complete a Carthaginian peace, but the hateful memory left in Taiwanese minds will make their islands permanent troubles in Chinese domestic affairs, and the shocking image left in the World's eyes will put the Chinese foot in a wasps' nest, at least in the short term. China consequently will have to pay a lasting and heavy cost both on Taiwanese soil and in its foreign relations if a war against Taiwan protracts. Thus, *fu jiu* will be the military guideline for Chinese to conduct an all-out invasion against Taiwan. Alternatively, if the purpose of a Chinese use of force is not to seek an absolute conclusion of the Taiwan issue, but rather a phased settlement, the military means they can employ will be much more flexible and can be adjusted to the progress of their political offensive. The ideal way is to prolong the military pressure without massive bloodshed. By using strategies such as "blackmail," "limited, reversible probe," "controlled pressure," "*fait accompli*," or "attrition,"<sup>14</sup> the Chinese increase their own bargain chips. By maneuvering the possible division in Taiwan and taking advantage of the fear that the American may have, the Chinese could force Taiwan back down. The Chinese military pressure may range from high-intensive military exercises, envelopment but short of attacks, to limited attacks. Once the confrontation occurs, China may target Taiwanese armed forces or military installations only, but its uppermost goal will still be designed to topple the Taiwanese will to resist Chinese coercion. In such a scenario, defeating Taiwanese armed forces is not necessary, instead, the main targets will be focused on both the Taiwanese and any third parties' wills. Then, *fu gong* will be the preferred way for China to employ its military force in such a limited confrontation.

若中國人民解放軍全面進犯台灣，無論是否將與台灣的地面部隊周旋，都至少得要先擊垮台灣的空軍的大部並隨後或同時中和掉台灣海軍的存在。其要達成這項任務不外有三種選項：決戰、消耗與使用非傳統武器。但若還要達成「非久」的要求，則只有決戰與使用非傳統武器兩項方案。首先，就使用非傳統武器來講，由於台灣軍事基地多離人口稠密的都會區不遠，中國若使用生化武器，平民死傷的機率將遠大過戰鬥人員。同樣的，使用核電磁脈衝攻擊，固然可對軍用器子設備造成傷害，但同樣的也會造成航空器、車輛等造成影響，<sup>15</sup>亦無法避免平民因之傷亡。兩者所造成的平民死傷數目，或許不若傳統武器，但仍將引起台灣居民巨大而久遠的憤恨。而且，無論這樣的武器如何地「乾淨」，在國際間仍為認為是野蠻的大規模殺傷性武器。特別是一旦中國使用了核子武器，將是二次大戰之後的第一次使用，而且是在對手無核子武器的狀態下率先使用。國際間將不得不進行干預與制裁。因此，對中國而言，使用非傳統武器，不僅不見得能夠減少平民傷亡下達成「非久」，反招惹國際間的必然干預，權衡之下，並非可行。

If the PLA invades Taiwan in an all-out scale, no matter whether the head-on fights between both ground forces will follow or not, it is essential for the PLA to destroy most ROC Air Force (ROCAF) first and neutralize the being of the ROCN next or simultaneously. There are only three options for the PLA to achieve the task: decisive battle, attrition, or the use of unconventional weapons. Considering the further demand of *fu jiu*,

only a decisive battle and the use of unconventional weapons are regarded as options for the PLA. First, concerning unconventional weapons, if the PLA uses biological or chemical weapons against Taiwan, the probabilities of civilian casualties will be much higher than the combatants' since most of the Taiwanese military bases are located not far from populous urban areas. Also, if the PLA detonates nuclear electromagnetic pulse (EMP) attacks against Taiwan, it can damage some military electronic equipment as well as some civilian airplanes or vehicles,<sup>15</sup> nor can heavy civilian casualties be avoided. Such attacks would certainly be followed by lashing Taiwanese rage, even if civilian casualties were no higher than those resulting from conventional weapons. In addition, no matter how "clean" these weapons can be, they are internationally recognized weapons of mass destruction. If nuclear weapons are used by Chinese, it will be not only the first case of using nuclear weapons but also the first use against a non-nuclear state after World War II. It will leave other countries with no other options but intervention and sanction. Therefore, using unconventional weapons in the Chinese calculation will not be a practical option since it can not promise to achieve the goal of *fu jiu* without heavy civilian casualties while, on the contrary, it can surely provoke international interventions.

其次，就決戰來講，作者在此定義決戰為「取得決定性戰果的會戰」，而會戰是「大部隊在一定時間內於特定戰場上的交戰行動」。<sup>16</sup>此處的「決定性」有兩項特徵：一是，在軍事上，殲滅敵方主力，使之無法繼續有組織的抵抗；二是，在政治上，被擊敗一方的政治領導人承認戰場的判決並達成雙方乃至其他相關各造均可接受的政治安排。<sup>17</sup>在過程上，會戰要雙方投入大規模兵力接戰，若一方求戰，一方迴避，是會而不戰。決戰要會戰產生決定性的戰果，若無，則戰而未決。現今台灣的作戰概念仍強調保存戰力，不鼓勵與中國機艦進行早期的大規模決戰，以「戰略持久」破中國「非久」的企圖。<sup>18</sup>但當中國以像是一九五〇年代的「百機偵巡」威脅金門、馬祖的方式，以龐大的機隊逼近台灣本島領空。縱有我方（在中國地對地飛彈攻擊下）倖存的地對空飛彈可以與部分來襲敵機接敵，但還是需要我方升空攔截的戰機去應付剩下來的敵機。而當雙方戰機接近時，「境外會戰」的態勢難以避免。以雙方指管通電情偵蒐的能力、載台的性能與人員的素質來看，除非來襲中國空軍戰機配備大量先進中程空對空飛彈或者是台灣大部分的空軍基地與重要的指管通電情偵蒐中心先為中國飛彈所癱瘓，否則中國將很難能在會戰中取得決定性戰果。在蘭德公司的電腦模擬中，一場大規模的台海空中會戰的前四天，中國空軍與台灣空軍將可能會有高達七五%與四五%的戰損。<sup>19</sup>若依此比例，若中國動用千餘架戰鬥機以奪取空優，一場四天空中會戰下來，將只剩二百六十架，而台灣近三百五十架戰機中，仍存近二百架。敵我戰機的數量比，將從會戰前二·八五比一拉近到會戰後的一·三比一。儘管我們未必需要認為台灣在這種境外會戰裡握有勝券，但可以認為中國在會戰裡討不到便宜。而一旦戰而不決時，則將延宕成長期的消耗戰，「非久」的可能性隨之消失。

Second, as regards a decisive battle, the authors call it "a campaign which brings about decisive results," and define a campaign as "an engagement between two or more sizable forces conducted within defined geographic and time limits."<sup>16</sup> "Decisiveness" here has two characteristics. In a military sense, it means to annihilate enemy's main

forces to the extent of making further organized resistance impossible. In its political aspect, the political leaders of the beaten enemy must be persuaded to accept the verdict of battlefield; and agree to a political settlement which is not only acceptable to the warring parties, but also to other interested parties.<sup>17</sup> Observing the process of a decisive battle, it is achieved by fulfilling two more criteria: (1) Both parties are required to commit sizable forces to the campaign. If only one side thirsts for a campaign while the other avoids it, no campaign will be produced. (2) A campaign must bring about decisive results. If not, it is a campaign without decisiveness. The current operational concepts of Taiwanese armed forces still stress the conservation of military capabilities. Using "strategic sustainability" to disorient Chinese attempts of *fu jiu*, a campaign at the early stage is therefore not encouraged.<sup>18</sup> However, if the PLA Air Force (PLAAF) launches a large amount of warplanes approaching Taiwan's territorial airspace (as they did in a pattern of "sortie of hundred planes" threatening Kinmen and Matsu in the 1950s), the ROCAF warplanes will be called in to engage the enemy even Taiwan's surviving (after the assaults of Chinese missiles) surface-to-air missiles can intercept some of the invading planes. When sizeable warplanes from two sides are approaching each other, a sequential "campaign outside territory" can be hardly averted. Comparing both C<sup>4</sup>ISR capabilities, performances of platforms, and qualities of personnel, unless most PLAAF modernized warplanes are equipped advanced medium-range air-to-air missiles or the Chinese missiles can paralyze most ROCAF bases and critical C<sup>4</sup>ISR centers, it is very difficult for the PLA to get the decisiveness they want in such a campaign. In a simulation run by analysts of the RAND, after four days of a large-scale air campaign, the loss rates of warplanes will be about 75 and 45 per cent for the PLAAF and the ROCAF, respectively.<sup>19</sup> According to their theoretic proportion, if the PLAAF deploys some 1,000 warplanes for the task of seizing air supremacy, only 260 planes out of them will survive after a four-day air campaign, while the ROCAF still holds near 200 out of the 350 fighters at its disposal. The proportion of warplane quantity between the PLAAF and the ROCAF will be improved from 2.85: 1 before the campaign to 1.3: 1 after the campaign. It may not be safe to say that the ROCAF can win such a campaign outside territory without difficulties, however it is sufficient evidence to conclude that the PLAAF gains no significant advantage from it. When a campaign brings out no decisiveness, and the war is prolonged, the chance of *fu jiu* dims consequently.

中國固然很難能迅速地擊潰台灣軍隊，但不能低估中國仍然極有可能在全面的進犯中重創我軍，特別是當這樣的入侵結合了奇襲與同時性因素對我海軍所構成的威脅。中國海軍航空部隊極可能在第一波入侵空軍戰機的掩護下，利用我方空軍全力保衛空優的情況下，乘隙攻擊我海軍艦艇。目前中國海軍航空兵可動用不少於一百架（包括轟六、強五、殲五、殲七與殲八一／二型等各款戰機）具發射攻船飛彈能力的定翼戰機擔任這項任務，可發射的飛彈包括舊式的C-601（射程在一百一十公里）到新式的C-801（射程四十公里）與C-101（射程九十公里）等各款飛彈。在這種飽和性攻擊下，將至少有二百枚不同款式攻艦飛彈的攻擊我海軍在台海巡弋的艦隻與停泊左營、馬公、基隆各基地的艦隻。加以中國的潛艦，亦可能利用我方艦隻疲於防空而反潛機暫時避離之際，進行突襲、封鎖或佈雷，更大大地增加我海軍因應上的困難。

The PLA may find it very difficult to defeat the Taiwanese armed forces quickly, but it can not be underestimated that the PLA is capable of hitting the Taiwanese hard in an all-out invasion, especially for the ROCN when such an assault combines with elements of surprise and simultaneity. The PLAN air arm, covered by the PLAAF first wave invading planes and taking advantage of most ROCAF planes are busy at air supremacy campaign, can launch a concurrent assault against the ROCN vessels. In such a scenario, the PLAN can send out at least some 100 fixed-wing warplanes, which are capable of launching anti-ship missiles (including B-6s, A-5s, J-5s, J-7s and J-8 I/IIs), to execute the assault. These PLAN planes carry varied types of missiles, from obsolete C-601 (range: 110 km) to advanced C-801 (range: 40 km) and C-101 (range: 90 km). In a saturated assault, the PLAN planes can blaze approximately 200 varied-type anti-ship missiles against the ROCN patrol dispatches on the Taiwan Strait or anchored vessels at Tzuoying, Magung, and Keelung naval bases. Yet pressing even more sharply on the ROCN's response to a simultaneous surprise is that the PLAN submarines will probably implement attacks, blockades, or minelaying when the ROCN fleet have their hands full running the air defense and when their ASW planes are temporarily disengaged.

二  
II

如果中國動武的目標旨在階段性地處理台灣議題，理想的武力運用方式是「非攻」。軍事上，「非攻」是不直接攻擊。就軍事與政治間的互動，概括而論，「非戰」的政治性要高過軍事性，軍事準備用來支援政治策略；而「非久」的軍事性要大過其政治性，以軍事武力達成政治攤牌，而「非攻」則介於兩者之間，是「打談合一」。最理想的「非攻」藉由武力的展示與進一步升級的威脅，使對方陣營自行瓦解，萬不得已，須以實際使用武力以強化此一威脅時，「非攻」的界線在以側擊、包圍或孤立等形式，藉由武力的有限或局部使用與進一步升級為全面戰爭的威脅，加速敵方陣營的內部瓦解的速度。因此，「非攻」可以是介於高強度武力威脅與有限戰爭間的任一點。而一旦以有限戰爭形式出現，在目的、手段、作戰區域、使用武器或目標選定上將有所限制。<sup>20</sup>對於中國領導人而言，「非攻」具有二項優點：第一，此一選項一方面既規避了「戰而不決」的軍事風險，另一方面也處理了不對台灣行動的國內政治風險。第二，此一選項的軍事成本較易控制，一方面不需要將其現代化水平參差不齊的大部份兵力孤注一擲，而可選擇其規模較小但素質較高的拳頭部隊來執行任務，而另一方面可依政治情勢發展進行升級與降級，保持進退彈性。不過，對中國而言，「非攻」也有幾項不確定的因素存在：第一，須賴台灣國內政情配合。第二，外來干預的可能性與方式。第三，雙方軍事對峙開來，容易擦槍走火，逸離原有規劃。第四，台灣軍隊將因中國的舉動而提高戒備，奇襲的利益喪失。以中國的軍事實力與兵力結構，中國欲達成「非攻」的具體軍事作為甚多，唯若與雙方海上兵力有直接關連的想定，主要有近接的海上武力展示、有限度的海上攻擊或封鎖三項。

The ideal way for the Chinese to use force is *fu gong* if their purpose is to seek a phased settlement. *Fu gong*, in a military sense, is not to commit a frontal assault. Ob-

serving politico-military interactions, generally, political priority in *fu zhan* prevails over military considerations; military preparation is used for reinforcing political strategy. In *fu jiu*, the characteristics of the contest is more military than political; military force is used to achieve a political conclusion. However, *fu gong* lies in-between; it is a "combination of fighting and negotiating." A perfect use of *fu gong* is to make enemy's camp distract and self-collapse by demonstrations of force and threats to further escalation. If the actual use of force for strengthening such threats are needed, the ceiling of *fu gong* is utilizing outflank, envelopment, or isolation to speed up enemy's self-collapse through limited or local uses of force and threats of a total confrontation. Thus, *fu gong* may locate itself at any point of a conflict spectrum ranged from high-intensive military intimidation to limited war. Once *fu gong* appears as a form of limited war, its political objectives, military means, operational theater, weapons or targeting will be confined.<sup>20</sup> For the Chinese leadership, *fu gong* has two advantages. First, this option not only can escape from the military risks of "campaign without decisiveness", but also avert domestic political risks of inaction toward Taiwan. Second, the military cost of such an option is much more controllable. On the one hand, it do not have to stake sizeable PLA troops, whose degrees of modernization are varied, on a single venture, but to deploy their fist units, a smaller but qualified elite force, to execute such a task. One the other hand, the Chinese keeps the freedom of further actions to escalate or de-escalate depending on political situations. However *Fu gong* also inherits four kinds of uncertainty from its nature: first -- perhaps the most vital one -- the domestic politics within Taiwan; second, the possibilities and forms of outside intervention; third, the possibilities of losing control in an intensive military confrontation; fourth, a deprivation of surprise advantages because the Taiwanese armed forces will be on alert. To execute a *fu gong* strategy, Chinese military capabilities and force structures provide broader options; however, considering those involving both the ROCN and the PLAN directly, the scenarios of impending shows of naval force, limited naval attacks, and blockades merit our attentions.

砲艦外交一詞由來既久，海軍武力作為脅迫或嚇阻的工具較之陸軍武力或空軍武力具有「彈性」與「明顯」兩項重要的優點。<sup>21</sup>就台海而言，除了少數的快反部隊如十五空降軍)，中國要動員地面部隊以發動危機的速度相對較慢，而且也只能在中國沿岸（例如：東山島）以演習的方式展示武力，要影響台灣百姓，通常還需透過香港媒體誇大的傳播。而使用空中戰機威脅，固然速度較快，也能以逼近「台海假想中線」的方式清楚傳達訊息（如九八年我國提出「特殊國與國關係」後），但缺點是雙方戰機在高速下相互逼近時場面容易失控，縱使能多批次逼近，總無法在中線「逗留」。而中國軍艦與我方軍艦在中線附近遭遇而併艦行駛的情形雖然並不罕見，但若中國動用大量艦隻在接近台灣附近逗留演訓或越過中線，就脅迫程度來講，將不下於九五、九六年的導彈演習。因後者已有先例，故一旦中國採取近接的海軍武力展示，將是強度更高的武力威脅行動。

Gunboat diplomacy is nothing new. Naval forces as an instrument of compellence or deterrence have long been thought to possess advantages of "flexibility" and "visibility" *vis-a-vis* land power and air power.<sup>21</sup> In the case of the Strait, the speed for the Chinese to mobilize its ground force to initiate or respond a crisis is relatively slow, except for some rapid reaction units (for example the 15th Airborne Corps). Moreover, the de-

demonstration of ground forces is only practical through drills around Chinese offshore islands such as Dongshandao. In order to influence Taiwan's population, it usually needs to take the form of exaggerated broadcasts through the media in Hong Kong. Using warplanes to coerce Taiwan has the advantage of swiftness and can use the approach of advancing the "tacit middle-line of the Taiwan Strait" to convey clear political messages, as they did after Taiwan announcing "special state-to-state relations" in 1999. However, in such a scenario, the situation may be easily taken out of Chinese hands when well-armed airplanes from two sides are approaching each other in sonic speed. In addition, these planes can not always "stay" on the spot even with high sortie rates. It is not rare for Taiwanese warships to chance upon and shadow their Chinese counterparts around the middle-line. However, if the PLAN deploys a fleet of warships staying or exercising in Taiwan's vicinity or crossing the middle-line, in the terms of Taiwanese threat perception, this would be no less serious than the missile crises in 1995/96. Considering the latter has been an established precedent, such a demonstration of naval forces will perhaps constitute a higher intensive act of coercion.

中國海軍對我海軍艦隻進行有限攻擊，有可能因為一般海事糾紛而引起的偶發事件，亦有可能來自武力展示的進一步升級。前者，一方面政治訊息不明，另一方面我方已建立由執法單位現場處理、海軍艦隻遠距監控的處理模式，大大降低中國藉題發揮的可能。而後者，一旦雙方交火且產生傷亡，將是自一九六五年十一月烏坵海戰（中國四艘砲艇被擊沈，台灣一艘掃雷艇被擊沈）與一九六六年十月突擊閩江口（中國二艘砲艇被擊沈）以來的雙方海軍首度交戰，情勢將急遽升高。

A PLAN limited attack against the ROCN vessels can be caused by maritime incidents or escalation from demonstration of naval forces. Besides political messages can not be signaled properly in the former instance, Taiwan has already established a prudent procedure, only police boats will come to handle such an incident while the ROCN warships monitor from a distance. This largely deprives the Chinese the possibility to use it as an excuse. However, in the latter instance, once open fire and casualties occur, it will be the first fighting between two navies since the Battle of the Wuchiou (November 1965, 4 PLAN gunboats and 1 ROCN minesweeper sunk) and the Assault of the Min River (October 1966, 2 PLAN gunboats sunk) and the situation will drastically intensify.

至於海上封鎖，這是一種比較複雜而模糊的想定，作者將多花些篇幅來說明。封鎖，是一種海軍作戰態樣，也可被視為一種海上交通的狀態。作為後者，只要某水域有戰火波及之虞，除非有母國軍艦護航，一般商船大概就會避開此一水域，因此勿待交戰國做出封鎖的宣示，自然有若干程度封鎖的效果。作為前者，這是海軍作戰的常態，從十九世紀以來的戰爭，只要交戰國一方擁有海軍，就會有封鎖。<sup>22</sup>在稱呼上，封鎖固然有許多不同講法，但廣義來說，它的方法，以實施區域分有近接封鎖與遠距封鎖，以實施對象分則有針對民用船隻的商業封鎖（打擊價值取向）與針對軍用船隻的海軍封鎖（打擊武力取向）。商業封鎖與海軍封鎖通常併用，但前者目的在削弱敵方的經濟，而後者旨在中和敵方艦隻干擾我方海軍行動的能力或誘使敵方海軍出港決戰。<sup>23</sup>

A blockade is a relatively complex and ambiguous kind of scenario; the authors therefore invest more attention on it. "Blockade" is a form of naval operation as well as a perceived status of maritime traffic. As the latter, so long as the possibility of being affected by spreading hostilities exists, merchantmen, unless being escorted by navies from their parent countries, will prevent themselves from entering the troubled waters. Some effects of an actual blockade are therefore produced even without an official declaration. As the former, a blockade is a common form of naval operation: few wars since the 19th century have been without a blockade if one side or the other possessed a navy.<sup>22</sup> A blockade varies in verbal expressions. But, generally speaking, its methods, distinguished by the operational area, are "close blockade" and "distant blockade"; or, by targeting, "commercial blockade" which targets against civilian merchantmen (countrervalue use) and "naval blockade" which aims against naval vessels (counterforce use). In practice, both "commercial blockade" and "naval blockade" are intrinsically linked and indistinguishable. But the former aims at weakening the enemy's economic potential while the objectives of the latter are to neutralize the capability of the enemy's navy for opposing our naval activities at sea or to lure the enemy to come out and fight.<sup>23</sup>

中國若使用海軍封鎖對付我海軍，由於缺乏可資利用的扼制點，實難有實施遠距封鎖的條件。而實施近接封鎖，若陳兵於海峽中線附近，揚言攻擊我出港軍艦，將可能演變成由近接武力展示的逐步升級。若直接以水面艦隻或海航飛機進行關閉港口的行動，勢必得先在全面戰鬥中先行取得制空權後，或在爭奪制空權作戰中，始有可能實施。然而，一旦中國使用潛艦，前面這些成本、風險與不確定性均可大大地降低。在宣布海軍封鎖的同時或之後，潛伏的中國潛艦可以對我軍港實施佈雷或甚至攻擊我軍艦。在軍事上，其效果最多可達成海軍封鎖的目的，把我海軍大部兵力中和掉，或至少造成封鎖的印象讓我軍疲於耗時耗力的反潛與掃雷作業。而所需的成本，最壞不過是損失若干潛艦。但以台海周邊的水文條件（下敘）而言，中國潛艦在這樣的突襲後全身而退的機率並不低。此一行動，在政治上不僅造成以「非攻」促談的壓力，而且能夠攫取有利的談判籌碼。故權衡之下，在「非攻」想定中，以潛艦執行海軍封鎖是非常具吸引力的方案。

Regarding a naval blockade, it is quite out of the question for the PLAN to conduct a distant blockade against the ROCN because no exploitable chock-points can be used by the PLAN. However, in a close blockade scenario, if the PLAN displays their forces around the middle-line and threaten to attack any ROCN warships that come out, it will pose a impending show of naval force and possibly lead to a limited exchange between the two navies. Also, if the PLAN wishes to close the ROCN bases in direct action by warships or warplanes, it is only possible after or during the battle for air supremacy in an all-out attack. However, if the PLAN employs submarines, the above costs, risks or uncertainties can be significantly reduced. Chinese infiltrated submarines can lay mines off the ROCN bases or even attack Taiwanese warships when or after China declares a naval blockade. In the military aspect, its effect at most is to achieve a typical naval blockade and neutralize most Taiwanese warships, or at least can create a image of being blockaded and make the ROCN busy at time-consuming and laborious ASW or mine clearance operations. The cost the PLAN must sustain in such an operation can be limited to the loss of few boats at worst. However, considering the underwater conditions

in Taiwan's vicinity (see below), the possibilities for Chinese submarines to escape from hunting after their attack are not low. By such a move of *fu gong*, not only can China exert pressure to negotiate on Taiwan, but also seize an advantageous bargaining position. Therefore, for China, using submarines to execute a naval blockade is an attractive option in a *fu gong* scenario.

至於針對民間航運的商業封鎖，基本上，要真正拖垮一國的經濟或軍事潛能，通常需要時間與投注相當規模的艦隻執行封鎖與反反封鎖。<sup>24</sup>因此，儘管在敵對狀態中商業封鎖並非罕見，但多為主要交戰行爲的象徵性延伸，對勝負並無太大影響。在現代史上利用海上封鎖而真正能對敵國經濟與軍事潛能帶來毀滅性效果的例子，大概只有英國對德的封鎖（第一次大戰）、德國潛艦對英的封鎖（第一次大戰、第二次大戰）與美國對日本的封鎖（第二次大戰）。而且，以現代戰爭的節奏，商業封鎖能否及時發揮效用也值得懷疑，例如一九七三年贖罪日戰爭中埃及儘管能有效地箝制以色列的海上交通，但在此一封鎖未見影響前，戰爭已因埃及陸戰上的潰敗而結束。<sup>25</sup>因此，在全面戰爭中，封鎖是必然的，但耗時耗力的封鎖至少將使得戰爭無法「非久」。不過，這並不是說商業封鎖毫無用處。在「非攻」的想定中，商業封鎖是極具吸引力的工具，特別是針對高度仰賴海運的海洋國家。對這些國家，即使海上交通線受到些微的威脅或箝制，在心理上都將倍感不安。在此，封鎖，作為懲罰性或報復性的強制形式，<sup>26</sup>乃是一種「傷害的能力」，傷害敵方最感到重要的或恐懼的部分。這種傷害，儘管不能直接達成目的，但利用它與進一步加重傷害的威脅，使敵方產生屈服的動機。<sup>27</sup>對中國領導人來說，這提供了「非攻」的另一種可能性。

Concerning a commercial blockade, it basically takes time to wear down the enemy's economic and military potential. It also needs huge naval assets to execute a blockade and counter the enemy's anti-blockade.<sup>24</sup> Therefore, although blockades always come together with the starting of hostilities, most of them can be regarded as symbolic extensions of main operations and contribute little to the final victory or defeat. Only in a very few cases, such as Britain against Germany in WWI, Germany against Britain in WW1/WW2, or America against Japan in WW2, have the blockaders really brought about devastating effects on the enemy. Furthermore, considering the operational tempo in modern warfare, it is questionable that a blockade can produce the anticipated effects in time. For example, Egypt had conducted a successful blockade against Israel in the Yom Kippur War of 1973, but the war ended in Egyptian defeat on land long before any significant effects of such a blockade might produce.<sup>25</sup> Thus, a blockade is inevitable in an all-out war, but its time-consuming and laborious nature makes the demand of *fu jiu* unattainable. This is not, however, to say that blockades are unfeasible as options. In a scenario of *fu gong*, on the contrary, the blockade is an attractive option especially used against oceanic states that heavily depend on maritime traffic. For them, even a slight disturbance of their maritime traffic will produce a large annoyance and pain psychologically. Here, a blockade, as a punitive or retaliatory form of coercion,<sup>26</sup> is "the power to hurt", intending to inflict damage on what an enemy treasures and what scares him. Such a "hurt" can usually achieve nothing directly, but to exploit the threat of damage or of more damage to come, it tries to structure the enemy's motives towards complying.<sup>27</sup> For the Chinese leadership, it provides another alternative of *fu gong*.

海運的安全是台灣生存發展的命脈。台灣貿易進出口九九・三%依賴海運。以民國八十九年為例，台灣五大國際港之進出港船舶總艘次為七一、三四五艘次，台灣五個國際港進出船舶數量與比例為：高雄港三六、〇〇七艘次，佔五〇・五%；基隆港一八、三二二艘次，佔二五・七%，台中港一一、六六四艘次，佔一六・三%，花蓮港四、二五一艘次，佔六・〇%，蘇澳港佔一、一〇一艘次，佔一・五%。這個統計數字告訴我們台灣在海運上天然的脆弱點：有高達九二・五%的船舶集中於面對中國大陸的西岸三大港進出。<sup>28</sup>然而，與一般貿易貨運相比，台灣能源海運進口的安全問題，更令人憂心。以原油來說，台灣日常消耗的每一滴原油均需進口，以民國八九年計，台灣進口原油二五八、七六五千桶，其中約九八%的原油進口必須經由暴露的南海航線。即使中國考慮到南海水域的政治敏感性而未予阻攔，但我國進口油輪全部集中在西部海岸外的二處泊地——高雄大林埔（高雄港以南，佔七八・八%）與桃園沙崙（竹圍附近，佔二一・二%）——以浮筒進行卸油。油輪須繫泊在浮筒上，由連接至岸上油槽的浮筒油管進行卸油作業，作業需時二十四小時（十五萬噸以下油輪）到四十小時（三十萬噸油輪）。這樣的地點與時間，都足以讓中國的機艦進行集中與從容的攻擊。同時，台灣所進口的二九七千公噸航空燃油（包括戰機用油）中，有四五%來自南韓，須經黃海與東海回國，而在這些水域裡，中國的阻擾將更無政治上的顧忌。<sup>29</sup>

For the Taiwanese, the security of maritime traffic means their survival and development. 99.3 per cent of Taiwan's trading cargo relies on maritime shipping. In 2000, the total numbers of inbound and outbound merchantmen of Taiwan's five international harbors reached 71,345 vessels. Among them, Kaohsiung Harbor occupied 50.5 per cent (36,007 vessels), Keelung Harbor 25.7 per cent (18,322 vessels), Taichung Harbor 16.3 per cent (11,664 vessels), Hwaiien Harbor 6 per cent (4,251 vessels), and Suao Harbor 1.5 per cent (1,101 vessels).<sup>28</sup> By the statistics, the nature of Taiwan's strategic vulnerability in regard to maritime traffic declares itself. In term of vessels, 92.5 per cent of shipping concentrates on three western coast harbors, all of which are facing Mainland China. Yet pressing even more sharply on Taiwan's maritime security than the general weakness of commercial trade is the vulnerability of its energy imports. Every single drop of crude oil we consume must be imported. In 2000, Taiwan imported 258,765 thousand barrels of crude oil; nearly all of them had to be carried through the exposed sea-route on the South China Sea. China, for reasons of political sensitivity, may not intercept Taiwan's tankers on the South China Sea, but all imported tankers must moor at single buoy moorings and discharge their load by pipelines connecting with oil storage on the shore at two offshore moorages - Dalinpu (located to the south of Kaohsiung Harbor; 78.8 per cent of total oil imports) and Shalun (near Chuwei, Taoyuan County; 21.2 per cent). The discharging procedure takes 24 hours (for 150,000 tons tankers) to 40 hours (for 300,000 tons tankers). Undoubtedly, the locations and duration facilitate the opportunity for the Chinese warplanes and warships to organize concentrated and unperturbed attacks. Meanwhile, 45 per cent of our aviation fuel, including that for military use, is imported from the South Korea through the route on the Yellow Sea and the East China Sea; in these waters, China can intercept them with less political scruples.<sup>29</sup>

中國海軍執行商業封鎖，有可能以海上武力展示的方式來擾亂台海周邊水域的

海上交通，亦有可能以小規模武力行使的方式，進行攔截、搜查、捕獲或甚至擊沈我部分商船。而後者與距離及相對位置有關。距離與相對位置是在戰略層面上影響海上作戰的最主要因素。<sup>30</sup>一個國家的海軍實力隨其離基地的距離之增加而遞減，除非能藉由大量的船艦在途中穿梭補給，否則當距離超出某特定地點後其海軍實力將毫無作用。<sup>31</sup>我國海軍現擁有七艘經改良過的陽字級驅逐艦、七艘成功（派里）級巡防艦、六艘康定（拉法葉）級巡防艦、八艘濟陽（諾克斯）級巡防艦，而未來還可能再增加四艘紀德級驅逐艦。集結這樣的實力固然可以在台灣鄰近水域形成局部優勢，但是也難以再抽出兵力去保護在南海或黃海水域的我國商船，再加上我國缺乏長程的空軍武力以掩護海軍在這些水域的行動。因此基本上，當中國機艦對我在南海或黃海水域的海上交通線進行襲擾，我國海軍很難馳援現地直接地予以因應。而對中國而言，以遠距進行商業封鎖，固可因我海軍難以馳援而降低軍事成本，但也有幾項不利之處。在公海上進行封鎖，容易引起國際間的抗議，對於台灣所有但外國註冊的商船，實施上將有所顧忌。且以中國的海軍實力，亦難以做到滴水不漏，加上我國可能組成船團，避開有利中國海軍投射兵力的航線（例如離繞南海），在近海會合後由海軍護衛返台。<sup>32</sup>

The PLAN has two options to execute a commercial blockade: applying a demonstration of naval forces to disturb maritime traffic in Taiwan's vicinity, or using limited forces to intercept, inspect, prize, or even sink some Taiwanese merchantmen. The latter involves the issues of distance and relative location. Distance and relative location are the primary geographical conditions affecting naval warfare at the strategic level.<sup>30</sup> The effectiveness of a state's naval power tends to decrease with its distance from its home base. Such a decrease, unless being mitigated by continuous and enormous supports all the way from the home base, will progress with distance to a point at which a state's naval power is virtually useless.<sup>31</sup> The ROCN now operates 7 modernized *Yang* class (modified version of U.S. *Gearing* class) destroyers (DDGs), 7 *Chengkung* class (modified version of U.S. *Oliver Hazard Perry* class) frigates (FFGs), 6 *Kangting* class (modified version of French *La Fayette* class) FFGs, and 8 *Chinyang* class (U.S. *Knox* class) FFGs. In the near future, 4 *Kidd* class destroyers are likely to be procured. Assembling them may establish local superiority at our home waters, but, then, no additional surface warship can be spared to protect our merchantmen sailing on the South China Sea and the Yellow Sea, nor does Taiwan have long-range air power to cover such naval operations in these waters. Thus, for possible Chinese interruptions against Taiwan's sea line of communication (SLOC) in these waters, the ROCN can hardly deal with it directly on the spot. For China, to conduct such a distance blockade can largely reduce the military cost as Taiwanese warships can hardly come to resist. But it also retains some disadvantages: to conduct a blockade on the high seas will generate worldwide protests and the Chinese may hesitate to use it against Taiwanese-owned foreign-registered merchantmen. In addition, the capacity of the PLAN can not support a complete blockade at a distance. Taiwan can organize convoys, avoid the route that the PLAN can easily reach, such as the South China Sea, and escorted by the ROCN when approaching Taiwan.<sup>32</sup>

若中國實施近接封鎖（如劃定禁航區、關閉港口等），軍事成本與風險均大為提高。與海軍封鎖同樣的情形，以水面艦隻或航空兵力執行封鎖，將遭遇台灣反反封

鎖措施時，至少會引起小規模的交火。而以潛艦執行，無論是採取佈雷或甚至象徵性攻擊一兩艘我方船隻，均可造成我進出海運大亂。

If China chose a close blockade (i.e. exclusion zone or harbors closure), the military cost and risk would largely increase. The same is the case with the scenario of a naval-close blockade, using surface warships or warplanes to execute such an operation will inescapably encounter with Taiwan anti-blockade force and lead to, at least, a limited exchange. However, if the PLAN uses submarines, to lay mines or symbolically sink one or two Taiwanese merchantmen, this will drastically weaken the security of Taiwan's maritime traffic.

中國現有六個潛艦支隊，服役潛艦約七十艘（包括夏級核動力彈道飛彈潛艦一艘、漢級核動力攻擊潛艦五艘、基洛級傳統動力潛艦四艘、明級傳統動力潛艦十九艘、宋級傳統動力潛艦三艘、羅密歐級傳統動力潛艦三十七艘、羅密歐級改良型導向飛彈潛艦一艘）。<sup>33</sup>北海艦隊下轄二個潛艦支隊，主要基地旅順、大連、姜哥莊（青島附近）與小平島（旅順附近）。東海艦隊下轄二個潛艦支隊（含全部四艘基洛級潛艦），主要基地大榭山及象山（均位於杭州灣）。南海艦隊下轄二個潛艦支隊，主要基地上、下川島（澳門附近）及榆林（海南島南端）。若中共對台動武，水下兵力將主要由東海艦隊與南海艦隊的潛艦支隊構成，除可能配合水面艦隊行動、擔任情報偵蒐或進入台灣海峽截擊我運補外島船隻外，亦可能形成內外兩封鎖線箝制台灣本島，內線為封鎖與襲港，主在局部封鎖台灣要港，特別是基隆、高雄與左營；外線為破交（破壞交通線），主在阻絕外來物資運補，並以向前部署來威懾美國介入台海衝突。<sup>34</sup>若用在對台近接商業封鎖，以基洛級來說，從杭州灣出航，保持水下十二節（六三六型水下最高速率十九至二十節，八七七型十七節），約可在二十二小時後抵達台灣北部海面，在可封鎖基隆港進出交通線上的位置就位。

The PLAN possesses 6 submarine squadrons, approximately 70 submarines in service including 1 *Xia* class nuclear-powered ballistic missile submarine (SSBN), 5 *Han* class nuclear-powered attack submarines (SSNs), 4 *Kilo* Class SSKs, 3 *Song* class SSKs, 37 *Romeo* class SSKs, and 1 modified *Romeo* class diesel-electric anti-ship missile-firing submarine (SSG).<sup>33</sup> The PLAN North Sea Fleet commands 2 submarine squadrons and bases them at Lushun, Dalian, Jianggezhuang (both near Qingdao), and Xiaopingdao (near Lushun). The PLAN East Sea Fleet commands 2 submarine squadrons, including all 4 *Kilo* SSKs, and bases them at Daxieshan and Xiangshan (both in the Hangzhou Bay). The PLAN South Sea Fleet commands 2 submarine squadrons and bases them at Shangchungdao, Xiachuandao (both near Macau), and Yulin (at the south of Hannan Island). If the PLAN moves against Taiwan, the submarine squadrons from both the East Sea Fleet and the South Sea Fleet will be committed. They can be deployed in combination with surface operations, in signals intelligence (SIGINT) operations, to assault Taiwan's supply ships on the route to its offshore islands in the Strait, or to constitute inner and outer blockade lines against the Taiwan Island. The PLAN submarines, which are deployed along the inner line, will aim at *fousuo* (blockade) and *xigang* (harbor-raid) Taiwan's major ports, especially Keelung Harbor, Kaohsiung Harbor, and Tzuoying Naval Base. Those are deployed along the outer line will execute *pojiao* (attack SLOC) to interdict the

interdict the inbound supply and, alternatively, by their forward deployment, to deter or attack possible American intervention.<sup>34</sup> In the scenario of commercial-close blockade, a *Kilo* class SSK (maximum submerged speed for the type 636 is 19-20 knots, for the type 877 is 17 knots), which sails out from its base in the Hangzhou Bay and maintains a 12-knot submerged speed, can arrive at its (inner line) station on Taiwan northern waters and threaten the Keelung Harbor within 22 hours.

### 三 III

中國的潛艦可在全面進犯台灣的想定中擔任突擊兵力的一部，也可在武力威脅或有限使用武力的想定中擔任封鎖的主力。而無論是哪一種運用型態，潛艦對中國海軍而言都是以低成本達成「非久」、「非攻」的有利戰具。對保障台灣海上交通安全的我國海軍構成極為嚴峻的威脅。在過去四十餘年，台灣海軍雖在反潛作戰的準備上不遺餘力，但由於潛艦作戰與反潛作戰上的不對稱性，此一威脅從未明顯減輕。

The PLAN submarines can play a role as a component of an assault force in the scenario of an all-out invasion as well as a main force of a blockade in the scenarios of threat to use of force and limited use of force. No matter which employment these submarines utilize, they provide an advantageous platform for the Chinese leadership to achieve their political goals of *fu jiu* or *fu gong* cheaply. The menace to the ROCN, which intends to protect the security of Taiwan's maritime traffic, poses a somber threat. During the past 40-odd years, the ROCN has invested significant resources in dealing with the PLAN submarines. However, due to the asymmetries between submarines operation and ASW, such a threat is never considerably reduced.

「潛艦，」一九一七年美國駐英大使佩吉這樣評價道：「是這場戰爭中最令人生懼的事物。」<sup>35</sup>潛艦之所以令人生懼，在於其匿蹤性，這是它最大的軍事價值。基本上潛艦在結構上要比水面艦隻脆弱許多，潛艦一旦被偵測到它的位置，在遭遇反潛兵力的追獵時，一枚深水炸彈的直接命中往往足以將之擊沈。因此，在偵測、鑑別、定位、追蹤與獵殺等五個反潛作戰程序中，<sup>36</sup>首要在於偵測到潛艦的位置。然而，潛艦並非完全不能被偵測出來。老式的潛艦不管它會發出多大的噪音，若無有效的反潛措施，照樣可以隱匿達成任務。同樣的，在反潛兵力嚴密且具決心的防護下，新型的潛艦無論它會多安靜，依舊有被偵測到與攻擊的危險。因此，潛艦的匿蹤性並非絕對的、不變的，而是相對的、動態的，其相對性由潛艦被反潛兵力所偵測到的機率來衡量，其動態性受到各種不同的客觀因素與主觀因素間的交互影響。在客觀因素上，包括：特定的地理條件、特定的水文環境與科技條件。在主觀因素上，則包括：作戰概念、接戰規則、人員素質與文武領導階層。易言之，潛艦作戰與反潛作戰的競爭焦點在於對潛艦匿蹤性的保障或剝奪，此一競爭的成功——無論潛艦或反潛兵力——繫乎於利用或改善地理條件、水文環境、科技因素、作戰概念、接戰規則、人員素質與文武領導階層。

Walter Page, the former American Ambassador in London, commented in 1917 that "The submarine is the most formidable thing the war has produced."<sup>35</sup> Stealth makes submarines so dreadful; it is the characteristic that is most valued about submarines in military operations. Submarines, in terms of structure, are much vulnerable than surface combatants. If a submarine is detected and attacked, a direct hit of one single depth charge can easily severely damage or even sink it. Therefore, during the five steps of ASW process (detection, classification, localization, tracking, and kill),<sup>36</sup> the primary and most difficult task is to detect the whereabouts of submarines. Submarines, however, is totally not undetectable. Without effective ASW measures, an obsolescent submarine, regardless how noisy it is, is still able to achieve its assigned mission surreptitiously. Under the determined and intense ASW measures, a modernized submarine, regardless how clandestine it is, always risks being detected and attacked. Therefore, the stealth of submarines is not absolute nor static, but rather relative and dynamic: the relativity is determined by the probability that submarines can be detected by ASW forces; the dynamics is governed by varied objective and subjective ingredients. The objective ingredients include specific geographic conditions, oceanographical environments, and technological factors. The subjective ingredients can be best understood by operational concepts, ROE, seamanship and politico-military leadership. In short, the core of the struggle between submarines and ASW forces is to maintain or diminish the stealth of submarines. To succeed in such a struggle is to utilize or improve geographic conditions, oceanographical environments, technological factors, operational concepts, ROE, seamanship, and politico-military leadership.

就客觀條件中的地理條件而言，依賴海運的海洋國家（如英國、日本與台灣），對於潛艦的威脅特別敏感，反潛作戰在這類國家海軍的建軍備戰中常具有高優先順序。反之，對於出海口有限或易遭箝制的陸權國家（如德國與前蘇聯），潛艦成為遠洋武力投射的可靠戰具。特別是當他們的水面兵力明顯居於劣勢時，潛艦更是其遂行不對稱戰法以中和敵方優勢水面兵力的重要工具。地理條件，相對上不易有所變化，但一旦獲得改善，往往能對潛艦的匿蹤性起明顯的放大或縮限的作用。例如：二次大戰德軍潛艦的匿蹤性在德國陸軍征服挪威與法國後，大大地增強，因為它們不再受到英國皇家海軍在北海一帶的監控，而可以直接從挪威與法國港口出海，幾乎不受羈絆地進入大西洋。<sup>37</sup>然而，當聯軍強化大西洋幾個重要島嶼（如冰島）的建設並部署陸基反潛飛機後，馬上明顯地削弱了德軍潛艦的活動能力。<sup>38</sup>

If we consider the first objective ingredient, geographic conditions, it is clear that oceanic states that heavily depend on seaborne communications, such as the United Kingdom, Japan or Taiwan, are very sensitive to enemy's submarine threats. For such counties, ASW should have the priority in their naval policy. For those land powers whose access to ocean are limited or can easily be choked, such as Germany or former Soviet Union, submarines are reliable platforms to project their naval power. More significantly, when their surface fleet is feeble, submarines can be used as important applications of asymmetric warfare to neutralize the enemy's superior surface fleet. Although geographic conditions are relatively constant, when they are improved, the stealth of submarines can be significantly strengthened or weakened. For example, the stealth of German U-boats in World War II was strengthened after their Army had occupied Nor-

way and France. This meant that U-boats were largely free from the Royal Navy's patrols in the North Sea and could easily enter the Atlantic Ocean from the occupied ports in Norway or France without serious interruptions.<sup>37</sup> But, after the Allies had strengthen some critical islands on the Atlantic Ocean, such as Iceland, the U-Boats' freedom of action was immediately and severely downgraded.<sup>38</sup>

台灣的地理位置對於海軍作戰有深刻的影響。受到狹小作戰區域與鄰近陸塊的緣故，台海鄰近水域並不利於大型水面艦隊的運動。而在這種狹海的作戰環境下，海軍作戰特別容易受到空中與水下的威脅所牽制。且更由於作戰縱深短淺，有利於奇襲。在現代高節奏與精準打擊的戰爭型態中，二支實力相當的海軍在狹海的作戰環境中遭遇，主動的一方將享有極大的戰術優勢。<sup>39</sup>因之，在全面戰爭中，除非一方取得持續的空優，否則稱台灣海峽將是水面艦隻的墳場並不為過。<sup>40</sup>而潛艦藉其匿蹤性，其作戰效能將在台海的狹海環境中更為加大。一旦爆發全面戰爭或中國有全面進犯之虞時，我國海軍艦隻將面臨到因應上的兩難。具有反潛能力的大型艦隻如果駐留於台灣海峽，將處於易遭攻擊的暴露位置。如果撤離至太平洋，在台海擔任警戒的小型艦（如飛彈快艇）與擔任「陸基洋面支援」的岸防飛彈均無法反制敵方潛艦的行動，<sup>41</sup>而當定翼反潛機也可能暫離戰火熾熱的台灣西部水域時，中國潛艦在台灣海峽的行動將幾乎不受干擾，爾後海軍大型艦再行進入海峽執行任務（如反登陸作戰）時，遇伏機率將更大。

Significantly, Taiwan's geographic location affects naval operations. The maneuverability of a big surface fleet is highly restricted because of the small size of operational area and proximity of the landmass. In such an operational environment of a narrow sea, naval operations are especially sensitive to airborne and undersea threats. Also, due to the lack of sufficient operational depth surprises are favorable. In an era of high-tempo and precise-strike warfare, if two navies encounter each other in a narrow environment, the side that seize the initiative will enjoy a much greater tactical advantage even the balance of forces is rough equal.<sup>39</sup> In a general war, unless one party obtains sustained air supremacy, it is not an exaggeration to say that the Taiwan Strait will be the graveyard of surface warships.<sup>40</sup> The military effectiveness of submarines, which is manifested by their stealth, significantly multiplies in a narrow sea environment such as the Taiwan Strait. Therefore, if a general war breaks out or is perceived to be likely to happen, the ROCN vessels will face a dilemmas in coping with them. If the ROCN large ASW-capable surface warships stay on the Taiwan Strait, they will put themselves in exposed positions where they are easily to be attacked. If they withdraw to the Pacific Ocean, any remaining small craft, such as missile boats, or coastal missiles that play a role of "land-based systems support sea-based systems,"<sup>41</sup> are not able to counter the actions of the PLAN submarines in the Strait. More disastrously, as a result of a severe air campaign, the ROCN fixed-wing ASW planes will be forced to withdraw from the western waters at least for a while. The PLAN submarines will therefore enjoy colossal freedom of action in the Strait. Later, when the ROCN large warships return to the Strait to execute their missions, such as anti-landing operation, the risks of being ambushed is considerably increased.

其次，以水文條件而言，海洋提供了潛艦的匿蹤性，大大地降低其被偵測與被

擊中的可能。因此，潛艦作戰與反潛作戰極度受到作戰區域內水面與水下（水深、洋流、環境噪音、水溫變化、海水鹽度等）條件所影響，而這些水文條件會使得潛艦的匿蹤性得到放大或縮限。雖然水文環境隨地區不同而有所變化，但基本上，水文環境越複雜，偵測的困難度增加，越有利於潛艦活動。

Next let us consider the oceanographical factors. The ocean provides the clandestine medium for submarines and largely reduces their probability of being detected and attacked. ASW and submarine operations are considerably affected by the surface and underwater conditions in the area of operation (e.g. depth, currents, background noise, water temperature, or salinity and so on). These conditions enhance or curtail the stealth of submarines. They vary from place to place, but, in essence, the more complex they are, the more difficult for ASW detection and, vice versa, the more favorable for submarine operations.

在水面上，天氣條件會影響反潛載台的操作。通常在海況四級（最大浪高一・二五公尺至二・五公尺）時，反潛直昇機的起降即受到影響，而到海況四至五級（五級最大浪高為二・五公尺至四公尺）時，巡防艦的艦艏聲納將受到限制，在海況五級左右時，拖曳聲納的收放作業產生困難。<sup>42</sup>台灣周邊水象並不穩定，西部沿海（台灣海峽），每年強風（蒲福風級六級，最大浪高三・五公尺）的平均天數五十九天，東部沿海（太平洋）每年強風平均天數為四十二天。<sup>43</sup>易言之，反艦艦隻的反潛作業在西部沿海有近二個月，在東部沿海有一個半月的時間，將因天候因素受到嚴重影響。

Above the sea's surface, the weather conditions will also affect the operations of ASW platforms. At Sea State 4 (wave height 1.25–2.5 meters), the operations of ASW helicopters will usually be disturbed. Bow sonars of FFGs will be limited at Sea State 4 to 5 (wave height 2.5–4 meters). ASW forces will find it difficult to stream and recover towed array sonars when the Sea State is above 5.<sup>42</sup> The weather conditions in Taiwan's vicinity are not very stable. The average frequency that the wind speed reaches the scale of strong freeze (Beaufort wind 6 degree, maximum wave height 3.5 meters) on the Taiwan's western waters (the Taiwan Strait) and the Taiwan's eastern waters (the Pacific Ocean) are 59 and 42 days per year respectively.<sup>43</sup> In other words, the operations of Taiwan's ASW forces will have serious disadvantageous weather conditions for one and half months (on the eastern waters) to two months (on the western waters).

以水下條件來講，水深與水底地形是偵潛難易的基本指標。深水區固然提供潛艦較多的運動空間，有利於其活動，但相對穩定的水下條件亦特別有利於高性能的長程聲納的偵潛。而潛艦在淺水區運動雖容易遭遇水雷、陸基反潛飛機的箝制，且一旦被偵測到往往無適當空間逃脫攻擊，然而，淺水區複雜的水文條件卻大大地減低聲納偵測的效果。<sup>44</sup>台灣周邊海域水下條件具高度複雜性，不僅東（太平洋）、西（台海海峽）側水深、水底地形與洋流變化差異度甚大外，加以平日均有大量漁、商船行經，常形成吵雜的水下噪音，這些將不利我國海軍的偵潛作業。仔細地說，<sup>45</sup>台灣海峽北段與中段為大陸棚淺水區，平均水深為六十公尺。除北有觀音凹陷（水深在六十公尺到八十公尺）、南有雲彰隆起（水深在四十公尺）外，全區水底平坦多

灘，基本上並不是潛艦運動的理想水域。但同樣由於水淺，海床反射與散射性強，降低偵潛效果；尤其夏季，聲波折射大，多隱蔽區，更不利於偵潛。因此，在此一水域，對於潛艦運動與偵潛行動均有限制，潛艦不易在此發動攻擊，因為一旦潛艦發動攻擊暴露位置後，在無足夠水深的限制下，極難逃脫反潛兵力的反擊。然而，偵潛行動亦難發覺潛艦在此的靜態活動，例如進行情報蒐集或佈雷之類。澎湖水道是值得注意的例外，其位置在雲嘉隆起以南、澎湖群島以東，向南延伸至台南外海，水深在此降至一百二十至一百六十公尺。澎湖水道是台灣海峽淺水區內唯一的潛艦庇護所，且左營（台灣本島最大海軍基地）、高雄（台灣最大商港）兩港在水道東南，馬公港在水道西北，故向被認為是反潛作戰與潛艦作戰的重要戰略水域。一九九四年五月二十五日，漢光十號演習期間，我國一架S-2T（當時仍由空軍操作）即在澎湖水道附近偵測出一艘潛伏的中共潛艦，我海軍緊急出動四艘陽字級驅逐艦、一艘濟陽級巡防艦與若干S-70C反潛直昇機抵達現場「監控」，在經長達四十五個小時的對峙後，此一極為嚴重的挑釁事件才在中共潛艦向西撤退落幕。<sup>46</sup>

With regard to the underwater conditions, the water's depth and underwater topographic condition are the basic indicators to evaluate the difficulties of detecting submarines. In the deep ocean submarines have more space to maneuver. However, the relatively stable underwater conditions enable it to be more easily detected by powerful long-range sonars. In shallow waters submarines are more likely to encounter minefields and enemy's shore-based ASW airplanes. This means it is more difficult for submarines to escape from hunting once they are being detected. The complex underwater conditions in shallow waters, however, pose serious challenges for ASW detection.<sup>44</sup> As for the complex underwater environments in Taiwan's surrounding waters, not only do the depth, sea bottoms, and currents between Taiwan's western waters (the Taiwan Strait) and eastern waters (the Pacific Ocean) differ greatly, but clattery ambient noise, produced by busy shipping or fishing, also make the enemy's submarines more difficult to detect by the ROCN. More specifically,<sup>45</sup> at the northern and middle sections of the Taiwan Strait is the shallow area of continental shelf where the average depth is approximately 60 meters. Except in the Guanyin Depression (60 - 80 meters deep) and Yunchang Rise (40 meters deep), the sea bottom of entire area is flat, featureless, and shoaly. It is not therefore ideal for a submarine to maneuver. However, the shallow environment in turn affects the probability of detecting submarines by the bottom reverberation and signal scattering. The disadvantage worsens for ASW forces where shadow zones are more easily produced by strong refraction (reflection of sonar ray) in the summer. Thus, at the north and middle sections of the Taiwan Strait, the underwater environment limits both the submarines' maneuverability and the ASW forces' detection. Submarines, for want of sufficient depth to maneuver, will find it very difficult to escape from the counter-strike of the ASW forces after they launch attacks and expose themselves. Nevertheless, it is also difficult for the ASW forces to detect submarines undertaking those relatively silent activities such as signal intelligence (SIGINT) collection or minelaying. The most important exception is in the Penghu Channel (located at the south of the Yunchang Rise, to the east of the Penghu Islands), which has a depth of 120-160 meters. Since the Penghu Channel is the only sanctuary for submarines in the shallow area of the Strait and near to Kaohsiung Harbor (Taiwan's biggest harbor), Tzuoying Naval Base (the biggest naval base in Taiwan Island), and Magung Naval Base, it is considered as the most im-

portant waters for the struggle between submarine operations and ASW in the Strait. In May 25 1994, at the peak of Taiwan annual Hankuang (then No.10) Exercise, a Taiwanese S-2T (then operated by ROCAF) detected a PLAN SSK concealing itself in the Penghu Channel. The ROCN scrambled four Yang class DDGs, one Chinyang class FFG, and several S-70 ASW helicopters to "monitor" the submarine. This serious provocation ended when the PLAN submarine withdrew westward after 45 hours of confrontation.<sup>46</sup>

台灣海峽南段除台灣灘（水深二十公尺）外，水深由八十公尺降至大陸棚邊緣澎湖峽谷、高屏峽谷的一千公尺後，進入大陸斜坡再急降至三千公尺。其水深足夠，且海流和緩，可說是極為適宜潛艦活動的區域。本區水域在春夏季時，受到水溫溫差梯度大的影響，聲波折射率變大，不利於偵潛；在秋冬季水溫結構穩定，偵潛效果良好。澎湖峽谷與高屏峽谷接於澎湖水道之南，為台灣海峽南段深水區進入北段淺水區的水下通道，並位於高雄港進出航線附近，是潛艦滲透、設伏的極佳地點。再往南，即進入南海水域。南海水域除東沙群島、中沙群礁、南沙群島附近水域外，水深在二千至四千五百公尺。全區為有利潛艦活動之深水區。

The depth of the southern section of Taiwan Strait (except the Taiwan Shoal which is 20 meters deep) increases from 80 meters to 1,000 meters at the Penghu Canyon and the Kaoping (Submarine) Canyon, two shelf breaks, then continues its course onto the continental slope (3,000 meters deep). The southern section of the Taiwan Strait is very suitable for submarine operations because of its relatively favorable depth and stable current. In the spring and summer, strong refraction caused by highly divided thermoclines degrades ASW detection, but there is no such problem in the fall and winter. Both of the Penghu Canyon and the Kaoping Canyon, which link the southern part of the Penghu Channel, are considered as ideal locations for submarines to infiltrate and ambush because they are natural passageways between the shallow section and the deep section of the Strait and also near to the route of Kaohsiung Harbor. Further southward it enters the South China Sea. Except for the surrounding waters of Dungsha Chiundao (the Pratas Islands), Jungsha Chiundao (the Macclesfield Bank) and Nansha Chiundao (the Spratly Islands), the average depth of the South China Sea ranges from 2,000 to 4,500 meters. The entire area is suitable for submarine operations.

台灣東部沿海除北面大陸棚、琉球島弧一帶（水深在八十至二百公尺）外，均為深水區域。宜蘭外海有沖繩海槽（夾於大陸棚與南面琉球島弧），水深由東北（六百至八百公尺）至西南（一千至二千五百公尺）遞增，最深可達二千七百公尺，由東北自西南分別有北棉花峽谷、棉花峽谷與基隆海谷切穿大陸棚，進入沖繩海槽。這幾個峽谷，是由東海大陸棚進入太平洋深水區的水下通道，且位於基隆港東北向航線附近，亦為潛艦滲透、設伏的極佳地點。宜蘭以南至綠島、蘭嶼一線以東離岸三浬後水深均劇降至三、四千公尺，特別是由北至南的和平海盆、南澳海盆、花東海盆與花蓮峽谷、花東峽谷，特別有利於潛艦活動。因本區有由南向北之黑潮主流行經，流速甚大，水底流場變化甚大，潛艦必須增加動力，以保持航向與速率，增加被偵測的風險；然而，亦因黑潮所帶來的多變水流與高溫、高鹽份海水，易產生折射現象，偵潛效果相對亦打折扣。台灣東部水域，既可能為我海軍疏散所用，也可能為戰時外援可能航線所經（即所謂「安全航道」），亦有蘇澳、花蓮兩處軍民兩

用戰略要港，傳統上亦被認為是反潛作戰的重要水域。

Besides the northern shelf and the Ryukyu Arc (80–200 meters deep), Taiwan's eastern waters is deep ocean area. The Okinawa Trough lies off the Ilan shore, its depth ranges from 600-800 meters (in the northeast) to 1,000-2,500 meters (in the southwest), and reaches its deepest at 2,700 meters. From northeast to southwest, the North Meinhua (Submarine) Canyon, the Meinhua (Submarine) Canyon, and Keelung (Submarine) Valley cut the shelf into the Okinawa Trough respectively. These canyons can be used for submarines to infiltrate and ambush, as they are the natural passageways between the East China Sea continental shelf to the deep Pacific Ocean and near to the route of Keelung Harbor. Water depth sharply increases to 3,000-4,000 meters at three nautical miles off the shelf breaks line from the south of Ilan to Liudau Island and Lanyu Island. In this area, submarines have relatively favorable maneuverability especially in the three deep basins (from north to south: the Hoping Basin, the Nanao Basin, and the Huatung Basin) and two canyons (the Hualien Canyon and the Huatung Canyon). Because of the passage of northward mainstream of the Kuroshio Current brings in fast and complex undercurrent, submerged submarines, in order to maintain their speeds and courses, often need to increase their propulsion and risk to be detected. However, the ASW detection is also discounted by refraction because of the unstable, temperate, and salty undercurrent which the Kuroshio Current brings in. Not only are Taiwan's two military-civilian dual used strategic ports, Hualien and Suao, located here, but this area is also the probable sanctuary for the ROCN main force as well as the possible routes for foreign aid (the so-called "safety route"), the ROCN traditionally considered the eastern as an important ASW area.

「以台海的音響條件，」誠如藍德公司分析師的公允評論，「對於反潛作戰的人員真是夢魘。」<sup>47</sup>而且，從以上敘述可知：台灣鄰近水域中，西南水域、東南水域與東北水域三區（見圖一）因水文條件與戰略因素將成為重要的反潛水域。若中國海軍欲實施近接的海軍或商業封鎖，預料將不會分散兵力於環島各地水域，<sup>48</sup>而是集中於此三處水域。只要中國潛艦干擾到這三個水域中六個主要港口的進出，而我方無法有效排除此一威脅，此一近接封鎖作戰即可認為成功達成。本文認為：若採取三艘潛艦採環形圍籬模式近接封鎖我方一要港，中國要達成封鎖的最低兵力需求將在十五至十八艘潛艦之間，<sup>49</sup>而我國海軍的估計則為十二至十六艘。<sup>50</sup>

Analysts from the RAND fairly commented that “the acoustic qualities of the Taiwan Strait make it a nightmare for ASW operators.”<sup>47</sup> Considering the oceanographic conditions and strategic importance, one can identify that the southwestern, southeast-

ern, and northeastern waters in Taiwan's vicinity will be the substantial ASW areas (see figure-1). If the PLAN executes a closed naval or commercial blockade, they will not, as some have suggested, scatter their submarines to all the waters around the Taiwan Island.<sup>48</sup> Instead they will concentrate on the above three areas. As long as the PLAN submarines disturb the traffic of the six ports in these three area and the ROCN ASW forces can not effectively expel such threats, the operation of the PLAN close blockade shall be considered as a success. The authors suggest that the PLAN at least needs 15-18 submarines to execute such a close blockade if they imitate a ring-fence pattern of using three boats against one Taiwanese port.<sup>49</sup> In the ROCN estimation, the PLAN will need at least 12-16 submarines for such a task.<sup>50</sup>

其次，就科技的因素而言，潛艦作戰與反潛作戰亦深受科技條件的波動所影響。在潛艦作戰與反潛作戰中，攻守雙方均會使用大量新式科技以改善對潛艦隱蔽性的利用或剝奪。因此，在三項客觀條件中，科技是最具動態性的，也是最難衡量的變數。

Next, we shall consider technological factors. Their changes can deeply influence the submarines operations and the ASW operations. In the submarines operations or the ASW operations, both sides will employ considerable advanced technologies to utilize or diminish the submarines' stealth characteristics. Thus, among the three objective ingredients, the technological factor is the most dynamical and immeasurable.

在潛艦科技與反潛科技的鬥爭中，有幾點值得注意之處：一，由於攻守的不對稱性，反潛科技往往很難做到滴水不漏，特別是在衝突一開始之時。反潛兵力的偵測方式，不外兩類：音響偵測與非音響偵測。音響偵測包括主動聲納與被動聲納；而非音響偵潛類主要則包括：目測、雷達、磁異偵測與電子情報。<sup>51</sup>但無論哪一種都無法擔保能在戰時發揮預期功效，反潛作戰的實施還是勞心勞力耗時的艱鉅任務，要成功擊毀敵方潛艦有很大部份還是得要靠幾分猜臆與運氣。第二次世界大戰前，艾斯迪克探測器（主動聲納的前身）是反潛艦隻的必備音響偵潛裝備，被認為將是終結德軍潛艦威脅的利器，一九三八年六月——幾乎就在戰爭爆發的前夕——英國皇家海軍還信心滿滿地宣稱艾斯迪克有百分之八十的偵潛成功率。<sup>52</sup>但如同德國海軍潛艦司令鄧克茲對他的對手的評價：「由於擁有這些水下偵潛裝置，二次大戰間的皇家海軍忽略了潛艦的威脅並低估了它的重要性。」<sup>53</sup>皇家海軍很快地發現聲納的偵潛效果並不可靠。水面艦隻為了降低本身的噪音以偵測潛艦，經常須降低速度到十節以下，反而增加受攻擊的機會；而使用聲納偵潛也易受到水底其他障礙物的反射波干擾，必須有相當專業的操作員隨時保持警戒加以辨認反射波的來源是否為潛艦。因為不可靠，早期聲納的有效偵測距離相當有限（約一千五百公尺），使得反潛艦隻經常必須暴露在潛艦的魚雷射程（四千公尺以上）內，一不小心反成了潛艦的獵物。英阿福克蘭戰爭是二次大戰後唯一一次大規模的反潛作戰，阿根廷四艘潛艦中只有二艘備便作戰，在聖加非號被擊毀（下敘）後，僅剩一艘聖路易斯號（德製二〇九級潛艦）。但為了防備它，英軍特遣艦隊幾乎日以繼夜保持反潛隊形警戒，但還是被聖路易斯號成功地滲透進去並發動數度攻擊。儘管聖路易斯號由於射控系統的故障並未有任何戰果，但其中一枚魚雷還是驚險地擊中了皇家海軍快箭巡防艦

所拖曳的誘餌，而聖路易斯號還是能在實施數度攻擊後安全脫身。<sup>54</sup>

Several considerations still need to be mentioned concerning the struggle between submarine technologies and ASW technologies. First, due to the asymmetry between offensive and defensive, ASW technologies can not guarantee complete protection from submarines especially in the early stages of hostility. The detection of ASW forces can be classified as both acoustic detection and non-acoustic detection: the former contains active sonars and passive sonars; the latter includes naked eye, radar, magnetic anomaly detection (MAD), and electronic support measures (ESM).<sup>51</sup> No matter what means are employed, they can not guarantee their anticipated effectiveness in the hostile environment. ASW remains being a laborious task, an “Awful Slow Warfare.” To sink an enemy submarine still needs guesswork and a stroke of luck. Before WWII, the asdic (predecessor of modern active sonar) was considered the most effective antidote to U-Boats. In June 1938, virtually on the eve of the WWII, the Royal Navy rosily assessed asdic's chances of detecting a submarine at 80 per cent.<sup>52</sup> “Thanks to the possession of these anti-submarine devices which worked under water,” commented Admiral Doenitz on his English counterparts, “the British Navy between the wars really had lost sight of the U-boats menace and had underestimated its importance.”<sup>53</sup> The Royal Navy soon found their asdic was not so reliable. In order to decrease the noise and to detect submarines, surface ships had to slow down to 10 knots, and consequently their chances of being attacked by submarines increased. Also, because the sonar detection was often confused by other obstacles on the seabed, it needed very professional operators to identify if the source of reflection was a submarine or not. On account of its unreliability, the effective detecting range of the early sonar was quite limited (approximately 1,500 meters), ASW ships often found themselves running into the torpedo range of the U-Boats (4,000 meters) and becoming the prey instead. The only case of large-scale ASW operations after WWII happened in the Falklands War of 1982. Only two out of four Argentine submarines were serviceable for combat. After the *Santa Fe* being destroyed, only the *San Luis* (a German made 209 class) was on patrol. However, even the Royal Navy task force almost kept extensive ASW formation all the time in order to defend against it, the *San Luis* still infiltrated into the British echelon and launched several attacks. Although the *San Luis* failed to achieve any damage due to malfunction of its fire control system, one of its fired torpedoes struck a decoy, which was towed by the HMS *Arrow*. This was a breathtaking near miss. The *San Luis* was still at large even after its several assaults.<sup>54</sup>

二，二次大戰之後，聲納設備的可靠度與有效偵測距離都大大提升，以台灣反潛的主力艦濟陽（諾克斯）級巡防艦的AN/SQS-26 聲納為例，在直接路徑模式下的有效偵測距離可達一萬八千公尺以上。<sup>55</sup>然而，許多美式反潛科技是針對前蘇聯的潛艦在深海水域內的活動而設計的，一旦這些裝備用在淺水或近岸水域，偵潛效果將大打折扣。反潛水面艦隻的被動聲納，是深海偵潛的利器，但在淺水或近岸水域的水文條件下幾乎難有作用，實際上只有高功率的主動聲納，才能發揮作用，而且有效偵潛的距離也將大大地縮減。<sup>56</sup>誠如我海軍分析人員所指出，由於敵情不明加上欠缺對水文條件的瞭解，反潛水面艦隻容易傾向過度依賴使用主動聲納的高功率聲波，而徒然「暴露自己的位置，造成敵暗我明」。<sup>57</sup>除了傳統主、被動聲納的精進之外，二次大戰後，最為重要的反潛科技發明是可變深（拖曳式）聲納、聲納浮

標、預置聲納、磁異偵測。可變深聲納可有效減少偵潛死角。聲納浮標，由艦載或陸基的反潛機上投放，可擴大偵潛範圍並擔任反潛水面艦隻的屏衛。預置（被動）聲納則預置於海床，部署於水道扼制點一線或要港外圍，進行預警偵潛。磁異偵測則是利用潛艦經過時所引起的地磁擾動效應偵測出潛艦的位置。對反潛兵力的偵潛，這些新科技提供了多重的選擇，並彌補了單以水面艦隻反潛的不足。不過，以台海狹淺水域的條件，這些科技還是不免有所限制。誠如前述，由於台海複雜的水下地形與密集航運所帶來高背景雜音，預置聲納的效能將大大縮限。機載聲納浮標與磁異偵測器，一到戰時，受到地理位置的影響，除非我空軍能有效掌握鄰近空域的制空權，否則海軍反潛機在台灣海峽水域極易受到干擾。而可變深聲納的拖放作業，在天氣因素的影響下，在台海鄰近水域有一個半月到兩個月的時間會受到影響。

Second, after WWII, the reliability and detecting range of sonar systems were considerably improved. For example, the detecting range of AN/SQS-26 sonar in *Knox* class FFGs, the main force of the ROCN ASW warships, is up to some 18,000 meters (at direct-path mode).<sup>55</sup> However, as some American ASW technologies were specially designed for dealing with Russian submarine operations in the blue waters, their effectiveness be discounted in the green waters or brown waters. Passive sonar of ASW surface vessels, a sharp ASW detecting equipment in the blue waters, can hardly utilize its advantages under the oceanographic conditions of the green or brown waters. Only active sonars in the high-frequency band within limited range have any practical chances of detection.<sup>56</sup> However, as one ROCN analyst correctly pointed out, due to the unclear situation and lack of awareness of oceanographic conditions, ASW forces tend to excessively rely on the high-frequency sound-beam of active sonars, and as a result only "expose their own positions."<sup>57</sup> Besides the improvement of existing active/passive sonar systems, the most important inventions of ASW technologies are variable depth sonars (VDS), sonobuoy, pre-positioned sonars, and magnetic anomaly detection (MAD). The VDS can effectively reduce shadow zones of detection. Sonobuoy, which is dropped by ASW land-based or sea-based planes, can extend the area of detection and screen ASW surface vessels. Pre-positioned (passive) sonars, which are laid on the seabed, can be employed as precautionary ASW measures outside important ports or at the choke points. The MAD takes advantage of the changes of magnetic background caused by submarines to detect their positions. For the detection of ASW forces, these new technologies provide multiple ASW options and cover the shortcoming of ASW surface vessels. Nevertheless, unavoidably these new technologies have some limitations when applied in narrow and shallow waters such as the waters in the Taiwan vicinity. As outlined above, due to the complicated topography and high background noise caused by dense maritime traffic, the effectiveness of pre-positioned sonars is restricted in the area. The use of sonobuoy or MAD is significantly influenced by the geographic location. In wartime, unless the ROCAF is able to establish air supremacy above the area, the ROCN ASW planes that carry sonobuoy or MAD system will severely curtailed. The operations of the VDS will also be seriously interrupted on account of the weather conditions in the area for one and half months to two months.

三，反潛作戰是由多重任務載台所實施的多載台任務。<sup>58</sup>因此，不同載台科技間的整合工作，會影響反潛作戰的整體效能，而更重要的，在這些有形的載台背後

的國防基礎建設——特別是指管通電情偵蒐系統——往往扮演決定性的角色。二次大戰最重要的反潛相關科技，也是反潛作戰鬥爭最為激烈的地帶，是遠離戰區的解碼技術。對於敵方指揮潛艦通信密碼的及時與正確的解讀，是護航船團避開潛艦攻擊與反潛兵力獵潛的關鍵。大戰初期英軍能解讀義大利海軍的密碼，因此能夠輕易掌握義大利海軍潛艦的位置與行蹤，因此義大利儘管有九十八艘潛艦，但在參戰後不到一個月，就有十艘被英軍擊沈或捕獲。<sup>59</sup>而當德軍潛艦進入地中海，帶來新的通信密碼技術後，英軍獵潛的戰績不僅直線下滑，德軍潛艦更使得英軍康寧漢將軍的地中海艦隊焦頭爛額。福克蘭戰爭中，阿根廷海軍所損失的唯一一艘潛艦（聖加非號），也是因為無線電通信被英艦截獲，而遭英軍艦載反潛直昇機所擊傷，最後在逃脫中觸礁而棄艦。<sup>60</sup>

Third, the ASW is a multi-platform mission area performed by multi-mission platforms.<sup>58</sup> Therefore, the whole ASW effectiveness is affected by the degree of the technological integration among different platforms. More importantly, the defense infrastructure behind the visible platforms (especially C<sup>4</sup>ISR systems) always plays a crucial role in the ASW. During WWII, the most important ASW-related technology as well as the fiercest area in the struggle of ASW is decryption. The timely and correct decryption of the enemy's cyphers is the key for the conveys to avoid ambush of the enemy's submarine and for the escorts to conduct the ASW. In the early stages of WWII, thanks to the British ability to read signals sent by the Italian Navy, no fewer than 10 out of 98 Italian submarines were located and sunk or captured within a month at Italy entering the war.<sup>59</sup> However, when German U-Boats moved into the Mediterranean theater and brought in new cypher technologies, not only did the prey of the Royal Navy ASW forces largely diminish, but the U-Boats also produced endless nightmares for Admiral Cunningham's RN Mediterranean Fleet. In the Falklands War, the sinking of the *Santa Fe*, the only Argentine submarine lost, was due to the Royal Navy task force picked up its radio communication. It was damaged by a British ASW helicopter and beached itself when it escaped. Later it was abandoned.<sup>60</sup>

四，傳統潛艦的最大本錢是體積與靜音。相較於核子動力攻擊潛艦動輒六、七千噸的排水量，傳統柴電潛艦在體積上要小上許多，以德製二〇九／一二〇〇型潛艦為例，潛航時排水量只有一、二八五噸。體積小，它所會形成的聲納截面也小。當它靜坐海底，幾乎難以偵測到。<sup>61</sup>不過，傳統柴電潛艦的最大弱點是：它以電瓶作為潛航時的動力，因之必須週期性地浮出水面或以呼吸管為電瓶充電，而此舉將使它自曝行蹤。受制於電瓶科技，在二次大戰結束前，潛艦不過是可以下潛的魚雷快艇。真正潛艦的出現要等到具有長期水下潛航能力核子動力潛艦發明之後。空權的興起與雷達的發明，使得進行充電的潛艦更倍感威脅。二次大戰後，許多因應的方案因之而生。第一種方案，是就呼吸管進行改善。二次大戰期間，德軍潛艦率先使用呼吸管進行充電，二次大戰後，西方各國相繼引用（甚至包括早期的核動力潛艦）。儘管使用許多方法（如使用吸收雷達波塗料或抗紅外線材質）以減少浮出水面之呼吸管的雷達截面，但它畢竟還是容易被現代化的反潛機的海面搜索雷達所偵測出來。而且一旦呼吸管阻塞，經常發生艦內迅速失壓，並可能造成乘員失去意識。<sup>62</sup>第二種方案是增進電瓶與柴油引擎的效能，以降低充電頻率與時間。現代化的柴油

引擎可將充電時間降低到每十二小時充電半小時。<sup>63</sup>第三種方案——或許是最具爭議性的一種——就是基洛級潛艦所採取的降低電瓶使用時間的方式。基洛級配備有SA-16 防空飛彈，意味它可能將以水面航行的方式，直到接近作戰區時方才下潛。在水面使用柴油引擎航行，可節約電池使用時間，而且可藉水面波浪降低被聲納偵測的可能，另一方面則藉防空飛彈防禦反潛機的空中威脅。<sup>64</sup>

Fourth, the great virtue of a SSK is size and silence. Compared with a 6-7,000 ton SSN, the size of a SSK is much smaller, for example, the displacement of German 209/1200 class SSK is only 1,285 tons (dived). A smaller SSK has an infinitesimal sonar cross-section. It is nearly undetectable when sitting on seabed.<sup>61</sup> The main weakness of SSKs is the use of batteries as source of submerged power and therefore the need for air to re-charge their batteries. It means a SSK must come out to surface or use a snorkel periodically and this will expose itself. Due to the limitation of battery technologies, submarines before the end of WWII were no more than submersible torpedo boats. A real submarine with unlimited submergibility was realized only after the invention of nuclear-powered submarines. Furthermore, the emergence of airpower and the invention of radar have seriously endangered a re-charging submarine. Many solutions therefore took shape after WWII. The first option was to improve the snorkels. German boats in WWII were the first to introduce snorkels. After WWII the western countries largely copied German snorkels and even used them in early nuclear-powered submarines. However, despite efforts, such as using radar-absorbing coatings or infrared defeating materials, to minimize the radar cross-sections of surfaced snorkels, they remain detectable, especially by advanced maritime patrol aircraft. Another disadvantage is that once the snorkels are blocked there can be a sudden loss of air pressure and this sometimes renders the crew unconscious.<sup>62</sup> The second option is to improve the efficiency of batteries or diesel engines and reduce the ratio and duration needed for re-charge. A modern diesel engine can cut the charging time to a half-hour in every 12 hours.<sup>63</sup> The third option, perhaps the most controversial one, is to reduce the time of using battery power, which the Russian *Kilo*-class SSKs adopt. The *Kilo*-class SSKs carry SA-16 surface-to-air missiles. It means that the *Kilo*-class SSKs may ride on the surface before they are near their operational areas. When they surface, they use diesel engines. This can economize on the use of batteries while not only reducing the chance of being detected by sonars because most of their diesel engine noise is transmitted into the waves, but also using their surface-to-air missiles for dealing with any possible ASW planes.<sup>64</sup>

第四種方案是所謂絕氣推進系統，目前有四種主要類型在發展中或已經服役：燃料電池、封閉循環柴油引擎、史塔林式循環引擎與封閉循環氣體渦輪。燃料電池的優點是利用氫與氧在系統低溫下發生反應，直接把化學能轉換為直流電。封閉循環柴油引擎是使用一具現有的標準柴油引擎加上一具吸取二氧化碳的去除器與一具水處理系統，氧氣則低溫儲存於真空的儲槽中。史塔林式引擎的概念是十九世紀前葉蘇格蘭神父羅伯·史塔林所提出，一九八〇年代瑞典皇家海軍潛艦大幅採用。史塔林引擎是最被廣泛使用的絕氣推進系統，其原理為使用高溫燃燒器之外燃引擎加熱液態氧來推動活塞。封閉循環氣體渦輪的概念有點類似魚雷的推進系統，是加熱氣體經過活塞，將熱能轉換為往復式推力，並利用蓄熱器將多餘的熱能送回重新循環。<sup>65</sup>絕氣推進系統是目前傳統潛艦最引人注目的科技，它使得傳統潛艦具備有接

近核動力潛艦的長期水下耐航能力。例如：加裝燃料電池的德製二〇九／一四〇〇級潛艦具有五十天水下耐航能力，加裝史塔林式循環引擎的瑞典製哥蘭級（A-19）潛艦宣稱具有較一般傳統潛艦多出五至七倍的水下耐航能力，加裝燃料電池的荷製莫瑞級（一八〇〇型）具有四十天水下耐航能力，使用封閉循環氣體渦輪的法製艾哥斯塔級潛艦具有四〇〇小時的水下耐航能力。<sup>66</sup>

The fourth option is air-independent propulsion (AIP) systems. There are four major variants of the AIP system in development or in service: fuel cells, the closed-cycle diesel engine, the Stirling cycle engine, and the closed-cycle gas turbine. The main advantage of a fuel cell is the direct conversion of chemical energy into electric DC power as hydrogen and oxygen react at low temperatures in the system. A closed-cycle diesel engine uses a standard off-the-shelf diesel engine with a scrubber for extraction of CO<sub>2</sub> and a water management system. Oxygen is stored cryogenically (LOX) in vacuum-insulated tanks. The Stirling engine (whose concepts were proposed by Robert Stirling, a Scottish clergyman, during the first half of the 19<sup>th</sup> century) was adopted in boats of Swedish Royal Navy after the 1980s. The Stirling engine is the most widely adopted technology of the AIP systems. The Stirling is an external combustion engine using a high-temperature continuous burner to heat LOX, which drives the pistons. The idea of a closed-cycle gas turbine is somewhat similar to torpedo propulsion. A gas is heated and passes through a turbine, which converts the heat energy into rotational force; the gas passes through a regenerator to capture excess heat and is recirculated back to the heat source to begin the loop again.<sup>65</sup> The AIP system is the most attractive SSK technology and provides SSKs with a underwater endurance which is comparable to that of nuclear-powered submarines. For example, the German 209/1400-class SSK with full cells AIP system has a underwater endurance of 50 days, the Swedish *Gotland*-class SSK with the Stirling AIP system has a underwater endurance that 5-7 times longer than conventional SSKs, the Dutch *Moray*-class (Type 1800) SSK with full cells AIP systems a 40-day underwater endurance, and the French *Agosta*-class (90B) SSK with MESMA AIP system, a French variant of closed-cycle gas turbine, has a 400-hour underwater endurance.<sup>66</sup>

如果說一九四〇年代晚期美國的古比級潛艦是綜合第一及第二次大戰潛艦的優點所研發出的第一代傳統潛艦的極致產品的話，那麼第二代傳統潛艦發展的極致大致將與俄製大型的基洛級潛艦相當。而配備有絕氣推進系統的傳統潛艦，可說是傳統潛艦邁向第三代的指標。第三代傳統潛艦，不僅承襲了第二代潛艦所有的自動化戰鬥系統、先進聲納系統、複雜電子支援設備與抗偵測的船殼外，絕氣推進系統更使潛艦具有更大的機動性與匿蹤性。同時，若干第三代潛艦更具有水下發射攻船飛彈（如美製射程約九十七公里的潛射魚叉飛彈與法製射程約五十五公里的潛射飛魚飛彈）、陸攻飛彈或自走水雷等潛能，<sup>67</sup>這使得第三代的傳統潛艦在戰力上有著與第二代傳統潛艦顯著的差別，當然在可執行任務的光譜上自然也要寬廣許多。

If we consider the *Guppy*-class SSK, which the U.S. had combined all desirable qualities of submarines in WWI and WWII and developed in the late 1940s, as the acme of the first-generation SSK, then the zenith of the second-generation submarines might be equivalent to the *Kilo*, a Russian underwater giant SSK. The arriving of the

third-generation SSKs has been declared itself by the maturity of the AIP systems. The third-generation SSKs not only inherit from their predecessors' automatized combat systems, advanced sonar systems, elaborate ESM systems, and anti-detection hulls, but also have greater mobility and stealth which is provided by the AIP systems. Meanwhile, some third-generation SSKs have capacities to sub-launch anti-ship missiles (i.e. American UGM-84 Sub-Harpoon, range 54 nautical miles; French SM-39 Sub-Exocet, range 31 nautical miles), land attack missiles, and mobile mines.<sup>67</sup> These developments enable a third-generation SSK to have a distinguishable combat potential from its predecessors and therefore widen the spectrum of missions that it can handle.

在本節中，作者概略敘述了台灣地理環境與水文條件對我海軍反潛作戰的限制。而且，儘管二次大戰後反潛科技有了長足的進展，但潛艦的匿蹤科技發展瓶頸在近年正展現突破性的發展。從這些敘述中，我們不難得到這樣的印象，那就是在台海水下的軍力平衡狀態，防禦的反潛兵力本來就有力有未逮之處，而日後這樣的失衡將更朝攻擊的潛艦兵力傾斜。在下一節中，我們將試著分析此一現象對我潛艦兵力運用上的意涵。

In this section, the authors describe the limitations which geographic locations and oceanographic conditions pose on the ROCN's ASW. Moreover, in spite of the progress of ASW technologies after WWII, the bottleneck of SSK stealth technologies has experienced a breakthrough in recent years. From these descriptions, we will have the following impression: the defensive ASW has some natural disadvantages in the underwater military balance in Taiwan's vicinity, and such an imbalance will be increased by an offensive submarine side in the future. In the next section, the authors will try to analyze the implications of such an inclination on the use of the ROCN submarine forces.

## 四 IV

孫子云：「昔之善戰者，先爲不可勝，以待敵之可勝：不可勝在己，可勝在敵。」<sup>68</sup>這樣的道理特別適用小國在面對大國時的軍事戰略，小國若自不量力，顛倒了「不可勝」與「可勝」的順序，試圖在軍事上與大國硬碰硬，平時將造成資源透支，戰時可能造成「小敵之堅，大敵之擒也」。<sup>69</sup>因之，在整體國力遠居中國之下的我國，「先爲不可勝」實爲我國防建軍的重心所在。

Sun-Tzu said "in antiquity those that excelled in warfare first made themselves unconquerable in order to await the moment when the enemy could be conquered. Being unconquerable lies with yourself; being conquerable lies with the enemy."<sup>68</sup> Such a lesson is especially useful for small states in constructing a military strategy to deal with their stronger opponents. If a small state is overconfident of its military capabilities, confuses the priority of "being unconquerable" with "being conquerable", and tries to enter into a head-to-head fight with its stronger enemy, it will not only bring about a deficit in resources during peacetime, but also, when war comes, produce what Sun-Tzu referred as "a small enemy that acts inflexibly will become the captives of a large enemy."<sup>69</sup> For

emy.”<sup>69</sup> For Taiwan, since its comprehensive national power is inferior to China, “being conquerable” should lie at the core of its defense construction.

況且，先制攻擊或預防性戰爭，本質上都是第一擊。對於台灣來講，軍事上它的實力不足以達成對中國眾多與深遠的目標進行解除武裝式的打擊，而且更重要的，在政治上此舉將無可避免地帶來難以想像的外交災難。說台灣像是一九六〇、七〇年代面對阿拉伯強鄰的以色列似有幾分道理，只不過以色列有的軍事選項，台灣要少上許多。

Furthermore, pre-emptive strike or preventive war, by its very nature, are forms of first strike. Taiwan's military capabilities can not support a first blow against China that would successfully disarm her numerous and deep targets. More importantly, such an act would inevitably lead to an unimaginable diplomatic disaster. Comparing Taiwan to Israel in the 1960s or 1970s, facing much stronger Arabian neighbors, seems to be justifiable, but, the military options which are available to Taiwanese are much fewer than those available to Israeli.

台灣目前的軍事戰略為「有效嚇阻、防衛固守」與前任政府的「防衛固守、有效嚇阻」軍事戰略間雖只是在中文名詞的順序加以對換而已，但據作者的瞭解，兩者在含意上是有所區別的。要認識此一不同，必須去理解兩個名詞間的關係。前任政府以「防衛固守」為手段，以達成「有效嚇阻」的目的，因之，台灣的國防戰略走的是所謂「阻卻型嚇阻」，也就以「縱深防衛」為手段，使中國認知到渡海攻台必須而付出慘重代價，而台灣可以藉長期支撐以獲得外來的即時援助，以此來嚇阻中國對台灣動武。在這樣總體戰的戰略思維下，台灣本島的防衛具有終極性的嚇阻介質，以中國攻佔台灣本島所需耗費的巨大成本來勸阻中國放棄武力犯台。但一九九五、九六年的飛彈危機，刺激了台灣修正「防衛固守、有效嚇阻」，中國飛彈的威脅或攻擊、海上封鎖的威脅或實施與針對一兩處外島進行包圍或攻擊等，雖然都只是武力威脅或有限戰爭型態，但仍足以對台灣的政經與社會產生巨大的影響，而這些在台灣本島地境以外的威脅或衝突，使得「防衛固守」的概念落空，當然也產生不了任何嚇阻的效果。新政府所提出「有效嚇阻、防衛固守」是在這樣的網絡中被提出，它是「防衛固守、有效嚇阻」的延伸，而不是取代。在概念上，新的戰略把「有效嚇阻」與「防衛固守」當作是雙元的手段，除了維持本島地面決戰作為最終嚇阻介質外，台灣將建立有限的本島地境線外武力投射（與防禦）能力，以嚇阻中國以飛彈、封鎖、襲擊外島等威脅或有限用武的方式。在過去，中國可以預知這些行動的可能代價，他可以根據台灣屈服的程度而幾乎不受干預地控制這些行動的風險。但在「有效嚇阻、防衛固守」的概念下，台灣正積極尋求這種境外武力投射（與防禦）能力，以使得中國難以預知代價與控制風險，從而有所忌憚。<sup>70</sup>

Taiwan's current military strategy is “Effective Deterrence and Strong Defense Posture”. Although the strategies of “Effective Deterrence and Strong Defense Posture” and “Resolute Defense, Effective Deterrence”, that were proposed by the preceding government, only differ by a change in Chinese word order, the two strategies, in the authors' perception, have different contents. In order to recognize their differences, it is necessary

to note the relationship between "Resolute Defense" and "Effective Deterrence". The preceding government used "Resolute Defense" as the means to accomplish the ends of "Effective deterrence". Therefore, Taiwan's military strategy at that time can be termed as "deterrence by denial". Defense in depth became the means of letting China think that if it crossed the Strait to attack Taiwan, it would have to pay a very heavy price. If Taiwan were able to withstand an attack for a long enough period of time, it would eventually receive foreign assistance. This would thereby serve to deter China from attacking Taiwan. Under such a "Total War" concept of total defense on the Island of Taiwan constituted the ultimate deterrent. It was designed to persuade China to recognize that to invade and occupy Taiwan would incur an enormous cost. The missile crises of 1995 and 1996 caused Taiwan to revise its "Resolute Defense, Effective Deterrence" strategy. Beijing's threat, or execution, of a missile assault, naval blockade, or attack on the offshore islands are all limited war operations with highly political implications. They would have a huge impact on Taiwan's politics, economy, and society. However, the concept of "Resolute defense" cannot deal fully with situations that erupt outside Taiwan and consequently produce no deterrent effect on such conflicts. Within this context, the new government's "Effective Deterrence and Strong Defense Posture" was proposed. It is more an extension of "Resolute Defense, Effective Deterrence" than a replacement. Conceptually, the new military strategy regards "Effective Deterrence" and "Strong Defense" as two dual, but separate, means. In addition to maintaining forces to prevent amphibious landing on the beaches of Taiwan as the uppermost deterrent, Taiwan also plans to build a limited force projection capabilities. This is in order to deter China's limited use (or threat to use) of force, such as a missile assault, blockade, or an attack on Taiwanese-controlled offshore islands. In the past, China could predict the military cost of such moves. Beijing can, almost without opposition, also control the risk by the degree of Taiwan's military inferiority. Under the strategy of "Effective Deterrence and Strong Defense Posture", however, Taiwan is seeking to build up a force projection capability in order to defeat China's strategy. Taipei wants Beijing to know that the cost and risk related to these moves can no longer be predicted or controlled. Taiwan's new strategy tries to introduce uncertainty to dissuade China from military intimidation or embarking on a limited attack against the island.<sup>70</sup>

因此，作者認為：在中國求「非久」的全面進犯想定中，我國海軍軍事作戰目標應建立在下面四項優先順序上：(一)降低中國第一擊對我軍力傷害，保存足以癱瘓或阻卻中國攻台能力的第二擊戰力；(二)保障我政經設施與民心士氣；(三)防止戰爭升級，減少平民與社會傷害；(四)尋求尊嚴地結束敵對並營造持久的和平。任何敵對都會結束而和平也必然會相伴而生，不過若要使尊嚴與持久的前提可被企及與可被達成，在不發第一槍的限制下，台灣首要必須建立能夠於中國第一擊下存活的「相當」第二擊能力。而在中國求「非攻」的有限攻擊或武力威嚇想定中，在不挑釁的前提下，我國海軍軍事行動應根據中國的行動建立四項不同的任務：(一)一旦中國採取近接的海上武力展示，我方應加以充分監控，並顯示不懼戰的決心；(二)一旦雙方海軍小規模交火，我方應先求減少損害；(三)一旦中國對我商業封鎖，我方應在不影響台灣防衛之前提下，組成護衛船團，保護重要物資進入台灣，並針對對方封鎖或反反封鎖兵力加以反擊；(四)一旦中國對我海軍封鎖，我方應避免戰力為敵所中和，並針對中國封鎖兵力加以反擊。因此，根據戰略指導、敵之威

脅性質與強度、地理與水文條件以及反潛與潛艦科技發展，作者建議：我國獲得新購潛艦後，應建立可執行下列四項作戰任務的能量：攻擊性／防禦性佈雷、襲擾敵人水面艦隻、聯合區域反潛作戰與危機時預防性部署。

Therefore, the authors suggest, in the scenario that the PLA aims at *fu jiu*, that the objectives of Taiwan's naval operations should be based on the following priorities: (1) To reduce our military loss which the Chinese first strike can cause, and to sustain a second strike capability that can paralyze or deny the Chinese to carry out an invasion; (2) To safeguard our politico-economic assets and populace morale; (3) To prevent from further escalation and to lessen civilian casualties and societal impairment; (4) To seek an honorable ending of the hostility and to construct a sustainable peace. All hostility will end. Some kinds of peace will follow. However, if we desire the prerequisite of honor and sustainability, under the restraint of "no first shot", then first Taiwan needs to have a "considerable" second strike capability that can survive under a Chinese first strike. Concerning the scenario that the PLA aims at *fu gong*, under the principle of non-provocation, the ROCN should judge the Chinese moves and seek to fulfill four different missions: (1) in the scenario of the PLAN's impending show of force, the ROCN should have the capabilities to monitor Chinese moves and to convey our resolve; (2) in the scenario of a small-scale exchange, the ROCN should attempt to limit its damage; (3) in the scenario of a commercial blockade, without jeopardizing Taiwan defense, the ROCN should organize convoys for protecting homeward critical imports and expel Chinese blockade forces or anti anti-blockade force from disturbing our convoys; and (4) in the scenario of a naval blockade, the ROCN must not be neutralized, it should counterstroke the enemy's blockade forces. Therefore, according to the previous analysis of the strategic guidelines, the nature and the degree of enemy's threats, geographic and oceanographic factors, and the progress of ASW and submarine technologies, the authors propose that, after obtaining the eight new SSKs, the ROCN should build capabilities for commencing the following four types of submarine operations: (1) offensive/defensive minelaying, (2) interrupting the enemy's fleet actions, (3) joint area ASW, and (4) preventive deployment in crises.

首先，台灣的海空軍並須能夠抵擋或承受中國猛烈與多層次的第一擊攻勢。但我大部分海軍水面艦艇既無法像空軍戰機能以強化掩體保護，而集中的程度又較空軍為高。一旦遭逢奇襲，易毀性也遠較空軍為高。要保存戰力，除了持續強化艦隊防空反潛能量以正面抵擋中國第一擊外，也可能其他的方式來間接地中和掉其攻擊的效果。而就後者來講，潛艦可能是最有效、經濟的方式。有分析家倡議「存在艦隊」的思想，以期能有效保持海軍戰力，待進行反封鎖作戰與反登陸作戰之用。<sup>71</sup>這雖不失為一可行的方案，不過，存在艦隊的思想，如同布朗迪教授對它的定義「是使敵方無法摧毀我方艦隊，因之敵方必須時時警戒我方的艦隊通過其所敏感的水域並造成顯著的傷害。」<sup>72</sup>在這裡，「存在」是不過是階段性的手段，真正讓敵方警戒的是：這樣的「存在」足以對敵方造成沈重的打擊。二次大戰期間，法國艦隊雖然能免於德軍的摧毀，但其「存在」無法造成任何顯著的效果，並隨著陸戰的結束成為戰利品。是故，以艦隊之存在來勸誘中國的最低嚇阻需求在於確保我海軍在中國的第一擊後仍具有「相當」戰力——仍能反擊並癱瘓或阻卻中國犯台的能力。而我

方「存在的潛艦戰隊」若能適切運用，將可具有此「相當」的戰力，並可在造成傷亡較小的情形下，讓尋求尊嚴地結束敵對並營造持久的和平之戰爭目標較有可能達成。

First, the ROCAF and the ROCN need to withstand or override the Chinese sober, multi-dimensional first strike. However, most ROCN vessels can not obtain protection from hardened bunkers nor disperse as the ROCAF planes do. Its vulnerabilities are expected to be much higher than the ROCAF in a surprise attack. In order to conserve their combat capability, the ROCN may continually keep upgrading its fleet in air defense and ASW capabilities for directly withstanding a Chinese first strike, or may alternatively use other means for indirectly overriding the effects of such an assault. Concerning the latter, submarines can be considered as the most cost-efficient option. Some naval thinkers believe that an operational concept of "fleet in being" can effectively conserve combat strength for upcoming anti-blockade and anti-landing operations.<sup>71</sup> This seems to be sound. However, the concept of "fleet in being," as defined by Professor Brodie, "if one has not been able to destroy the enemy fleet, one must be on guard to deny it access to those seas where it can do significant damage."<sup>72</sup> Here, to maintain "*a being*" is only a phased means. What can really make the enemy on guard is "*the being*" that is capable of inflicting significant damage on enemy military assets. In WWII, most French fleet escaped from the German attacks. However, their "*being*" produced no significant effects. Instead, they became intact captives after the defeat of land battles. Therefore, to use the "*being*" of our fleet to dissuade China, the minimum deterrent requirement is that the ROCN must secure a "considerable" combat strength, a capability that can commence a counterstroke to paralyze or deny Chinese military the capability of invasion. A Taiwanese "submarine fleet in being", if properly used, would not only have such a "considerable" combat strength, but also, under the limited causalities, let the war aims of seeking an honorable ending to hostility and constructing a sustainable peace more easy to achieve.

我國海軍在購進新的八艘柴電潛艦後，現有潛艦兵力將擴大至十二艘。若新購之潛艦為第三代的傳統潛艦，我國將會有第一代傳統潛艦二艘（古比級）、第二代傳統潛艦二艘（海龍級，荷製劍龍級改良型）與第三代傳統潛艦八艘。若以第一代與第二代潛艦用作訓練，當新購八艘第三代潛艦成軍之後，除非它們的後勤產生問題或船艦設計不良，否則台灣海軍應能設法維持四艘以上第三代潛艦隨時在海備便。而且，即使停泊港口的潛艦其本身雷達截面還是要比周圍的大型水面艦隻小上許多，若我海軍能改善目前過度集中駐防左營的現象，並且給這些戰略重要資產應有的掩體防護的話，在來襲的中國海軍航空兵密集的攻船飛彈突襲下，留駐港口的其他八艘潛艦仍有極高的存活機會。

After Taiwan obtains eight SSKs, the total amount of the ROCN submarine forces will increase to twelve SSKs. If these newly acquired submarines are all the third-generation SSKs, then the ROCN will have two (*Guppy*-class) first-generation SSKs, two (*Hailung*-class, Dutch *Zwaardvis*-class modernized version) second-generation SSKs, and eight third-generation SSKs. The four first- and second-generation SSKs can be used for training in peacetime after the eight third-generation SSKs come in service. Unless

these new third-generation SSKs encounter serious logistical problems or design flaws, it will be possible for the ROCN to maintain at least four of them on seas ready for combat at any time. Meanwhile, the radar cross-sections of other SSKs that remain in ports are still much smaller than the surface warships nearby. If the ROCN can improve the deep-seated problem of over-concentrating submarines in Tzuoying Base and use hardened bunkers to protect these important strategic assets, the remaining eight anchored SSKs have a good chance of survival even under a saturated anti-ship missiles assault of the PLAN air arm.

阻敵登陸要比殲敵於岸對於台灣本島的破壞較小。而且由於尚未進行大規模的陸上廝殺，這可使得雙方可 在尚未付出大量傷亡的情形下，較有可能促成敵對狀態的結束。同時，若能成功地使中國相信登陸無法成功或必將付出相當時間與代價，戰爭的進一步水平升級至台灣本島或許可以避免，中國的戰爭目標或許可以因之降低，戰時嚇阻才有可能達成。更重要的，中國軍隊是不是能踏上台灣的灘頭，對於我戰時的民心士氣將會有重大的影響。阻敵登陸，最低限度應防止中國入侵的兩棲特遣艦隊進入目標區水域，是為近距阻敵登陸；最理想則在防止中國艦隊出海，是為遠距阻敵登陸。近距阻敵登陸，為我空軍、海軍水面、水下艦隻與岸置攻船飛彈部隊（由海軍操作）的任務。而防禦性佈雷，是反登陸有效的措施之一。由潛艦擔任防禦性佈雷具有幾項優點：（一）若我海軍以四艘（第一、二代）潛艦，對台灣西部幾處適合於登陸的灘頭近海與可能被中國用作補給登陸部隊的港口外進行防禦性佈雷的任務。本文估計四艘在一航次共可部署一二〇枚水雷，<sup>73</sup>若一天每艘僅執行一航次，三天內，可部署高達三百六十枚水雷。換言之，在以爭奪制空權的空中會戰後（見前述），即使中國傾其所餘戰機掩護其兩棲特遣艦隊接近目標區，中國的艦隊還得要進行耗時與危險的掃雷。兩岸海軍目前的掃雷能力都是有目共睹的差，而中國海軍相形之下更差，中國現有掃雷艦三十四艘，但其中只有七艘近岸掃雷艦堪稱可用。<sup>74</sup>即令全數投入，仍難以迅速掃除水雷威脅。（二）潛艦擔任防禦性佈雷，可以減輕海軍水面艦隻的風險，海軍水面艦隻可撤離至東部水域，避免在非必要時進入台灣海峽。同時亦可節約海軍兵力，海軍能有較為充裕的兵力執行其他任務。（三）即令中國海軍強行進行掃雷，耗時將久，且須強大兵力掩護掃雷艦隻，而這龐大的艦隊耽留在台灣海峽，將自處於易受空中、水面與水下攻擊的暴露位置。（四）以潛艦進行佈雷是風險與成本較低的佈雷方式。瓦二次大戰期間，沒有一艘潛艦在佈雷時蒙受損失。<sup>75</sup>更何況在本國的水域內，潛艦防禦性佈雷享有地利之便。

Denying the enemy the opportunity of landing can lessen the degree of destruction on Taiwan better than annihilating the enemy on land. Moreover, without the large-scale casualties caused by land combat, the former option makes the end of hostility more accessible. Meanwhile, if we can make China conceive that its landing on Taiwan will be costly and time-consuming, or even impossible, the horizontal escalation, which will extend war into Taiwan, may be avoided. The Chinese may lower their war aims, and an intra-war deterrence may therefore be achieved. More importantly, the morale of the Taiwanese population in wartime could be largely affected if Chinese soldiers were to land their feet on Taiwan's soil. In order to deny the enemy a possible landing, the minimal requirement, or a close denial, is to prevent the PLAN Amphibious Task Force

from its targeted area and the perfect option, or a distant denial, is to block the sail of the PLAN fleet. A close denial is the mission of the ROCAF's warplanes, the ROCN's surface warships and underwater submarines, and the coastal anti-ship missile units (operated by the ROCN). Defensive minelaying is an effective measurement of a close denial. Using submarines to lay the sea mines has several advantages: (1) If the ROCN employs four (first- and second-generation) SSKs to lay mines off the beaches that are suitable for amphibious assaults or outside the ports that can be seized for supply the enemy's landing troops, the authors estimate that a total of 120 mines can be laid by these four SSKs every sortie.<sup>73</sup> If these boats maintain one sortie per day, they can deploy a total 360 mines in three days. In other words, even if the PLAAF gambles their surviving warplanes on covering the approach of the PLAN Amphibious Task Force after the air supremacy campaign (see above), the Chinese fleet still has to commence a prolonged and dangerous task of minesweeping. The problems of feeble minesweeping capabilities are common for the two navies cross the Strait, but, by comparison, the situation for the PLAN is more worse. On paper, the PLAN has 34 various types of minesweepers. Despite this, only seven coastal minesweepers (*Wosao*-class) are qualified for such a task.<sup>74</sup> Even if they are all put into action, it is still very difficult for them to clear the minefields in a short time. (2) Employing SSKs to lay mines can largely reduce the risks of the ROCN surface warships. The ROCN surface warships can be withdrawn to the eastern waters and enter the Strait only when necessary. Moreover, this will economize the uses of the ROCN surface warships. The ROCN will therefore have sufficient combat strength to deal with other threats. (3) Even if the PLAN decides to clear the minefields at all costs, it will require a strong screen force to cover the minesweeping operations. Such a force needs to remain at the Strait and put themselves in an exposed position where they can easily be attacked from air, surface, underwater, or even Taiwan's long-range artillery on land. (4) Employing submarines is a less risky and less costly way to lay mines. No submarine was lost in WWII while minelaying.<sup>75</sup> Furthermore, the ROCN SSKs will enjoy geographic advantages while minelaying in their home waters.

誠如前述，第三代潛艦的特色是匿蹤性與機動性都大為增強。我海軍應有新購之第三代潛艦執行前進部署的任務。平時，可在中國海軍基地附近公海執行監控，擔任戰術預警任務。一旦情勢升高，可在敵方對我發動攻擊後，利用中國水面艦隊反潛能力的不足（見下敘），立即針對中國海軍基地執行攻擊性佈雷。當然，以台灣有限數量的潛艦進行攻擊性佈雷，是無法完全防止中國海軍發動入侵，不過卻可延誤其艦隊迅速出海、阻卻其出海艦隊利用基地或吸引其轉移兵力。一艘前進部署的潛艦可在半數魚雷半數水雷的武器裝載下，攜帶約二十枚水雷，足以妨礙到中國一處海軍基地的正常進出。若其另配備如瑞典海軍潛艦所使用的外載水雷匣，將可多攜帶四十至五十枚水雷，<sup>76</sup>能嚴重影響到中國三至四處海軍基地的正常進出。對於缺乏足夠與先進掃雷能力的國家，針對重要海軍基地的攻擊性佈雷可在流血甚少的情形下，大幅且長期地中和對方的水面戰力。以美軍在越戰期間對北越海防港的水雷作戰為例，二十七艘海防港中的船隻被困達三百天，而美軍只用了七十五枚水雷。<sup>77</sup>

As above, both the mobility and the stealth of the third-generation SSKs are significantly strengthened. The ROCN can deploy its third-generation SSKs as for-

ward-deployed forces. They can be deployed in the high seas off the PLAN bases to monitor the PLAN's movements for the purpose of tactical early warning in peacetime. Once the situation worsens and Taiwan is attacked, they can, taking advantage of the shortcoming of the PLAN in ASW (see below), press home offensive minelaying off the PLAN bases immediately. For the ROCN, its limited submarine assets, of course, can not prevent the PLAN invasion completely, but it can delay the PLAN to put their fleet out to sea timely, deny the PLAN fleet at sea the ability to re-use the bases, or distract the attention of the PLAN fleet. A forward-deployed boat, at the load of half torpedoes and half mines, can carry approximately 20 mines and is sufficient to disturb the normal operations of one PLAN base. If the boat uses the external mine belts, which are widely equipped by the Swedish Royal Navy's boats,<sup>76</sup> it can carry a further 40-50 mines and can seriously disturb three or four PLAN bases. To a country without sufficient and advanced minesweeping capability, a minelaying offensive against its naval bases can largely and lengthy neutralize its surface fleet without much bloodshed. For example, in the U.S. mine operation against North Vietnamese Haiphong in the Vietnam War, twenty-seven ships were trapped in harbor for three hundred days and it only took the U.S. Navy seventy-five mines.<sup>77</sup>

台灣潛艦的第二項任務應利用中國水面艦隻反潛能力上的弱點，以防制其控有台海鄰近水域的制海權，並協助我水面艦隻確保這些水域內的制海權。中國海軍艦隊相當強調水面攻勢作戰，相對上在防空與反潛上的能力較為薄弱。為分析的必要，作者依反潛戰力將中國海軍與我國海軍的主要水面艦隻概略分為兩類（見表一）：第一類為反潛主要兵力：這類軍艦大多具有完整的水下聲納偵蒐裝備（主、被動聲納與可變深聲納）與一至二架標準反潛直昇機，可獨立執行反潛任務，若干並具有反潛戰鬥系統與反潛電子支援系統。以此標準，我國的康定級巡防艦、濟陽級巡防艦均屬之，而即使是被認為主在執行水面打擊／防空任務的成功級巡防艦亦具備有完整的聲納裝備、S-70 反潛直昇機與反潛戰鬥系統，這三款可說是目前台海兩岸反潛能力最佳的軍艦。或許由於中國海軍對潛艦的威脅認知不若我國海軍，中國海軍在反潛能力上的投資遠遠低於我國，旅滬級驅逐艦與旅大級二型驅逐艦是目前中國海軍在反潛能力較佳的艦種，前者是現代化的多功能艦，具可變深聲納系統，搭載二架直九反潛直昇機，並具有法製戰鬥系統，可說是目前中國海軍中反潛能力最強的艦隻。目前該型艦有兩艘服役（哈爾濱號，隸屬北海艦隊；青島號，隸屬東海艦隊）。旅大級二型驅逐艦，可說是旅大級一型艦針對反潛需求的改裝版，改裝後可搭載兩架直九型反潛直昇機，並加裝了可變深聲納。目前有兩艘同型艦（濟南號與大連號，均隸屬北海艦隊）。第二類為反潛輔助兵力：這類艦隻或無可變深聲納系統（或無完整聲納系統），或無反潛直昇機（或僅具小型反潛直昇機），難以獨立執行反潛任務，執行作戰時，須有前類反潛主力兵力加以屏衛。我國七艘陽字級（武進三型）驅逐艦僅具有小型的 MD-500 反潛直昇機與主動聲納，在反潛戰力上自然較之康定級巡防艦、濟陽級巡防艦或成功級巡防艦略遜一籌。中國海軍方面，兩艘現代級驅逐艦，雖具有可觀的反艦戰力，但在反潛裝備上表現平平，除了兩架直九型直昇機外，僅有主動聲納。十六艘旅大級驅逐艦是目前中國海軍主力艦種，但其中十四艘一型與三型艦，均無反潛直昇機，也只有主動聲納。新建的旅海級驅逐艦，雖可搭載兩架反潛直昇機，但在聲納設備上並無可觀之處。中國的巡防艦中除了九艘江衛級巡防

艦與一艘江滬級二型艦（四平號）有配備一架反潛直昇機外，高達三十艘江滬級一、三、四型巡防艦，甚至無反潛直升級，而這兩級巡防艦在聲納設備上與我各級巡防艦相差甚遠。依此水準，台灣擁有二十一艘堪任反潛主力兵力的水面艦隻，而中國在其六十四艘水面主力艦中，只有四艘在反潛戰力上能與我國反潛主力兵力相當。

表一：中國海軍與我國海軍主要水面艦隻之反潛能力

Table-1: The ASW Capabilities of the PLAN and the ROCN

類別 ASW Classifi- cation	艦級 Class of warship	數量 Num- ber	聲納系統 Sonar Systems	艦載反潛直 昇機 ASW heli- copter	反潛戰鬥系 統 ASW Com- bat Systems	反潛電子支 援系統 ASW ESM
Primary ASW Forces	康定級巡防艦 Kangting Class FFG	6	■■■■	■■	Y	Y
	成功級巡防艦 Chengkung Class FFG	7	■■■■	■■■■	Y	
	濟陽級巡防艦 Chinyang Class FFG	8	■■■■	■■	Y	
	旅滬級驅逐艦 Luhu Class DDG	2	■■■■	■■■■	Y	Y
	旅大級二型驅逐艦 Luda Class II DDG	2	■■■	■■■■		
Secondary ASW Forces	江滬級二型巡防艦 Jianghu Class II FFG	1	■■■	■■		
	現代級驅逐艦 Sovremenny Class DDG	2	■	■■■■		
	旅海級驅逐艦 Luhai Class DDG	2	■	■■■■		
	旅大級一型驅逐艦 Luda Class I DDG	13	■■■			
	旅大級三型驅逐艦 Luda Class III DDG	1	■■■■			
	江衛級一、二型巡防艦 Jiangwei Class I/II FFG	9	■	■■		Y
	陽字級驅逐艦 Yang Class DDG	7	■	■		Y
	江滬級一、三、四型巡防艦 Jianghu Class I/III/IV FFG	30	■			

The second mission for the ROCN SSKs in wartime should be to take advantage of the PLAN's weaknesses in ASW and interrupt their actions in order to deny their sea control in Taiwan's vicinity and to safeguard our own sea control which is established by the ROCN surface warships. The strength of the PLAN surface fleet lies in their anti-ship offensive capability, their anti-air and ASW capabilities are relatively weaker. For the analytic purpose, the authors classify the main surface warships of the PLAN and the ROCN in terms of their ASW capabilities as two groups: the primary ASW forces and the secondary ASW forces (see Table-1). Warships which are classified as the

primary ASW forces are usually equipped with comprehensive sonar systems (active/passive sonars and VDS) and one or two standard ASW helicopters. They are capable of commencing ASW independently, some are even equipped with advanced ASW combat systems and ASW ESM. By this classification, the ROCN possesses two powerful ASW-capable classes of FFGs: the *Kangting*-class and the *Chinyang*-class. Even the *Chengkung*-class FFGs, whose missions are mainly for strike and air-defense, are also equipped with comprehensive sonar systems, one S-70 ASW helicopter, and ASW combat systems. The above three classes are the most advanced ASW warships across the Strait. Perhaps due to the fact that the Chinese perception of submarine threats is not as sensitive as the Taiwanese, the PLAN's ASW investment is much less than the ROCN's. The *Luhu*-class DDGs and the *Luda*-class II DDGs are the only two classes of warships with advanced ASW capability in the PLAN. The former are modernized multi-purpose warships and can be seen as the most powerful ASW-capable warships in the PLAN, carrying the VDS systems, two Zhi-9 ASW helicopters, and French-built combat systems. Two *Luhu*-class DDGs are now in service (the *Haribing* based in the North Sea Fleet and the *Qingdao* based in the East Sea Fleet). The *Luda*-class II DDGs, an ASW modernized version of *Luda*-class I DDGs, carry two Zhi-9 ASW helicopters and have the VDS systems. Two *Luda*-class II DDGs are now in service (the *Jinan* and the *Dalian*, both based in the North Sea Fleet). The second group is the secondary ASW forces. Warships in this classification lack the VDS systems or ASW helicopters (or only smaller ASW helicopters). The secondary ASW forces can not commence ASW without the support from the primary ASW forces. The ROCN has seven operational *Yang*-class DDGs (Wuchin III conversion). Their ASW capabilities, one smaller MD-500 ASW helicopter and active sonar system only, are limited while comparing with the *Kangting*-class FFGs, the *Chinyang*-class FFGs, and the *Chengkung*-class FFGs. In the PLAN, although two *Sovremenny*-class DDGs have powerful anti-ship combat strength, their ASW capabilities are limited; each has two ASW helicopters and active sonar systems only. The sixteen *Luda*-class DDGs is the main force of the PLAN surface fleet, but fifteen Type I and III are only equipped with active sonar systems and without ASW helicopters. The newly-built *Luhai*-class DDGs will be equipped with two ASW helicopters, but no qualified sonars systems to be outfitted. Among the PLAN frigates, except the nine *Jiangwei*-class FFGs and one *Jianghu*-class II FFG (the *Siping*) that carry one ASW helicopter, the thirty *Jianghu*-class I/III/IV FFGs are even without ASW helicopters. The sonar system in the PLAN frigates can not compare with those in the ROCN's. According to the criteria, the ROCN has 21 warships that can be classified as primary ASW forces, while the PLAN only has four warships in its 64 main surface combatants.

因此，中國海軍在戰時必須高度依賴陸基與艦載反潛機或潛艦來協助反潛。在陸基反潛機方面，中國在帳面上有六十七架反潛機，但其中多為老式的H-5反潛機，能應付現代反潛作戰需求的僅有六架SH-5反潛機，在性能與數量均不及台灣現有的二十四架S-2E/T，更不用說是台灣後續添購的十二架P-3C。艦載反潛機方面，中國海軍現有三十四架標準反潛直昇機，我國海軍有二十架標準反潛直昇機，九架輕型反潛直昇機。平均每兩艘中國主要水面艦隻僅有一架反潛直昇機掩護，而我國則每艘均有一架，在比例上亦低過我國海軍。<sup>78</sup>若中國艦隊以潛艦擔任屏衛，至少需要一至二艘水下極速二十五節的漢級核子動力攻擊潛艦在速度上能夠匹配並保護一支快速移動的水面艦隊（下敘）。而即便中國海軍的反潛機都能發揮出原超乎其可能性

能的反潛能力，一旦中國艦隊離開陸基反潛機的安全偵潛（不受我方空軍反制）距離外，我方配備遠距打擊武器（如射程在九十七公里的潛射魚叉飛彈）的潛艦即可有效地在艦載反潛直昇機安全偵潛距離（以中國海軍目前艦隊區域防空的能力來看，此一距離約為四十公里，即SA-N-7/17 防空飛彈的最大射程）外，對中國入侵的水面艦隊進行打擊。而主要的打擊目標，將是中國海軍僅有的四艘反潛主要艦隻（旅滬級與旅大級二型驅逐艦），任何一艘的損失，都將嚴重妨礙到中國海軍的後續行動。

Therefore, the PLAN must rely heavily on land-based ASW planes, sea-based ASW helicopters, or submarines in the ASW operations. On paper, the PLAN has 67 land-based ASW planes, but most of them are antiquated H-5 ASW planes and only six SH-5s can meet the demands of modernized ASW. They are overwhelmed by the ROCN's 24 S-2E/Ts in terms of quality and quantity, let alone Taiwan's planned 12 P-3Cs. With regard to the sea-based ASW helicopters, the PLAN has 34 standard ASW helicopters while the ROCN owns 20 standard ASW helicopters and nine smaller ASW helicopters. On average, every PLAN's ASW helicopters will be required to cover two warships. The rate is inferior to the ROCN's which its every warship will be covered by one ASW helicopter.<sup>78</sup> If the PLAN employs submarines as the ASW screen of its fleet, it will need one or two *Han*-class SSNs whose underwater speed (maximum 25 knots) can match and protect one fast-moving surface fleet (see below). Even all PLAN ASW planes and helicopters can have performance that exceeds their possible technical description, as long as the PLAN fleet sails out of the safe covering range (a range that can be free from the ROCAF's interception) of land-based ASW planes, our submarines, carrying long-range weapons, like 97 Km Sub-Harpoon, still can effectively assault the PLAN surface warships even without entering the safe detecting range (a range that depends on the anti-air capabilities of the fleet, in the case of the PLAN, such a range will be no more than 40 Km, the maximum range of SA-N-7/17 SAM) of the PLAN ASW helicopters. The main targets of the ROCN submarines should be the four PLAN primary ASW warships (*Luhu*-class and *Luda*-class II DDGs). Any loss of them will seriously interrupt further actions of a PLAN fleet.

潛艦是海軍作戰中不對稱戰法實施的另一方式，具有力量倍增器的效果。一支在水面艦隻數量居於弱勢的海軍，可以藉由較為經濟的潛艦，依舊可造成敵方水面艦隻帶來嚴重的打擊。兩次大戰期間，德軍潛艦雖然都以商船主要攻擊目標，但當用來對付敵方水面艦隊時，所得的戰果一樣令人生懼。第二次大戰期間，德軍水面艦隊居於絕對性劣勢，除了短暫地擔任商船戰的配角外，大部分的時間是擔任防制盟軍登陸挪威的存在艦隊之用。真正能打擊英國水面艦隻，除了空軍外，就是潛艦。二次大戰期間，英國皇家海軍總共被擊沈了四艘戰艦，其中有二艘被潛艦所擊沉，比例為五〇%，而被損失的航空母艦有高達六二%（五艘）是由潛艦所擊沉（見表二）。而在狹海的地中海戰區，德軍水面艦隻無法到達，義軍水面艦隻畏戰，德軍潛艦與空軍相互配合的結果，使得英軍在克理特島與馬爾他島的作戰，都受到嚴重的牽制與損失。

表二：英國海軍在兩次大戰中被潛艦所擊沈的主力艦隻

Table-2: The Royal Navy Main Warships Sunk by Submarines

數量 Number 所佔比例 Percent of Being Sunk by Subs	第一次大戰英國海軍為潛艦擊 沈的主力水面艦隻 The Royal Navy Main War- ships Sunk by Subs in WWI <sup>a</sup>	第二次大戰英國海軍為潛艦擊 沈的主力水面艦隻 The Royal Navy Main War- ships Sunk by Subs in WWII <sup>b</sup>
戰艦 Battleships	5 (38.5%)	2 (50.0%)
航空母艦 Carriers	1 (33.3%)	5 (62.5%)
巡洋艦 Cruisers	8 (32.0%)	8 (24.2%)
驅逐艦 Destroyers	7 (11.0%)	38 (24.7%)

<sup>a</sup> HMSO, **Navy Losses**, reprinted as **British Vessels Lost at Sea, 1914-18 and 1939-45** (Northamptonshire: Patrick Stephens, 1919, reprinted 1988), Section I, p.8.

<sup>b</sup> Stephen Roskill, **History of The Second World War: The Navy at War, 1939-1945** (London: HMSO, 1960), Vol.3, Part II, p.448.此處數字包含皇家海軍所操作的盟國艦隻與皇家海軍租借其他盟國的艦隻

A submarine, by acting as a force multiplier, is one of the best platforms to conduct an asymmetric naval warfare. A navy, which although outnumbered by the enemy in terms of surface warships, still can deliver the enemy's fleet a serious blow with relatively low-cost submarines. German submarines during two World Wars mainly targeted merchantmen. However, when they chose to challenge the enemy's surface fleet, they achieved notable success as well. In World War II, the German Navy was totally outnumbered, most of the time, their fleet acted as a "fleet-in-being" for preventing the Allies from re-taking Norway. Occasionally it played a secondary role in assaulting the Allies maritime traffic. Only the Luftwaffe and U-Boats could be pitted against the Allies superior fleet. In World War II, two battleships (or 50% of total battleships lost) and five carriers (or 62.5 % of total carriers lost) of the Royal Navy were sunk by the enemy's submarines (see Table-2). In the narrow Mediterranean Theater where the German Navy main warships could not reach and where the Italian Navy dared not to engage the enemy more closely, only German U-Boats co-operated with the Luftwaffe could seriously disturb the Royal Navy's operations near Crete and the Malta.

潛艦是海軍武力遂行不對稱戰法的力量倍增器。前蘇聯海軍將領高西柯夫曾說：「英軍與美軍得動用二十五艘水面艦隻與一百架飛機對一艘德軍潛艦，每一個德軍潛艦官兵在海上服勤之際，就需有一百個英、美擔任反潛的官兵加以對付。」<sup>79</sup>我國海軍擁有至少先進於中國十年的反潛資產，在今日尚且無法解除潛艦威脅所造成的困擾。同樣的，我國的潛艦將會對中國海軍計畫人員帶來困擾將更為深刻，而這種的困擾在一定程度上將會影響到中國在台灣鄰近水域使用水面艦隊的信心。

Submarines are one of the naval force multipliers for executing an asymmetric warfare. The former Soviet Admiral Gorshkov said "for each German U-Boat there were 25 British and U.S. warships and 100 aircraft, and for every German submariner at sea there

there were 100 British and American antisubmariners.<sup>79</sup> Even today, the ROCN, whose ASW assets have been more advanced than the PLAN's for at least one decade, is still disturbed by submarine threats. It is certain that the ROCN submarines will bring a more disturbing feeling to the Chinese naval planners, and, to some degree, such a disturbance will affect their confidence to put their ships out to sea in Taiwan's vicinity.

在過去，反制潛艦的最重要作爲不是購置潛艦，而是建立反制潛艦的空中與水面武力。如表三顯示：二次大戰期間，在七百八十五艘被盟軍擊沈的德軍潛艦中，只有二十一艘是被盟軍潛艦所擊沈，比例不到三%。反制潛艦的最有效方式是空中與海上反潛兵力的攻擊：在大西洋戰區，空中反潛機是大西洋戰役中最具決定性的要素。盟軍陸基飛機在海上反潛任務中擊沈了二百四十五艘德軍潛艦，艦載飛機擊沈了四十三艘潛艦，對潛艦停泊港的轟炸中又擊沈了六十一艘，單以空中攻擊就擊沈了三百四十九艘潛艦（此一數字還不含由飛機與水面艦所共同擊沈的五十艘德軍潛艦），佔四四%。水雷的反潛效果甚至可大過潛艦。

In the past, the most important acts that ASW forces should take is not to buy submarines, but to establish a combined force of ASW planes and surface combatants. As illustrated in Table-3, in total 785 U-Boats lost in WWII, only 21 out of them (less than 3 %) were sunk by the Allies submarines. The most effective ASW means is the attacks from airborne and surface ASW forces. In the Atlantic Theater, ASW planes are the most critical factors in the Battle of the Atlantic. The Allies land-based and sea-based planes sank 245 and 43 German U-Boats; further 61 U-Boats were sunk in the Allies bomber raids against their bases. The Allies air force destroyed 349 U-Boats (44 percent of all U-Boats loss) and this figure did not include another 50 U-Boats which were classified as shared results with surface combatants. Even the achievement of sea mines in ASW was better than submarines.

而在潛艦的性能大大提升的現今，許多潛艦人堅信反潛的最佳武器就是潛艦。然而，在二次大戰之後，尚未有以潛艦擊沉潛艦的案例能夠加以證實。但可以確信的是，潛艦已完全整合成爲聯合反潛作戰眾多載台中重要的一環。例如：美國的航空母艦戰鬥群必須由二至三艘核動力攻擊潛艦的屏衛下護航；而在冷戰期間，潛艦在防堵前蘇聯潛艦南下的格陵蘭——冰島——英國一線反潛柵欄線亦扮演極爲重要的角色。

表三：潛艦戰損與戰損原因

Table-3: Submarines Loss and Causes

	第一次大戰 德軍潛艦損失 German Subs Loss in WWI <sup>a</sup>	第一次大戰 英軍潛艦損失 British Subs Loss in WWI <sup>b</sup>	第二次大戰 德軍潛艦損失 German Subs Loss in WWII <sup>c</sup>	第二次大戰 英軍潛艦損失 British Subs Loss in WWII <sup>d</sup>	第二次大戰 美軍潛艦損失 U.S. Subs Loss in WWII <sup>e</sup>	第二次大戰 義軍潛艦損失 Italian Subs Loss in WWII <sup>f</sup>	第二次大戰 日軍潛艦損失 Jap. Subs Loss in WWII <sup>g</sup>
數量 Total	178	54	785	90	52	84	129

主要損失原因與比例 Cause and Percent							
為水面反潛 艦隻所擊沈 Sunk by ASW Ships	72 (40.4%)	3 (5.6%)	246 (31.3%)	30 (33.3%)	NA	39 (46.4%)	61 (47.3%)
為水面反潛 艦隻與飛機 所共同擊沈 Sunk by ASW Ships and Planes	--	--	50 (6.4%)	--	6 (11.5%)	5 (6.0%)	7 (5.4%)
為飛機所擊 沈 Sunk by Planes	1 (0.6%)	--	349 (44.5%)	7 (7.8%)	5 (9.6%)	14 (16.7%)	12 (9.3%)
為潛艦所擊 沈 Sunk by Subs	18 (10.1%)	4 (7.4%)	21 (2.7%)	5 (5.6%)	NA	18 (21.4%)	22 (17.1%)
為水雷所擊 沈 Sunk by Mines	48 (27.0%)	4 (7.4%)	26 (3.3%)	29 (32.2%)	8 (15.4%)	--	4 (3.1%)

<sup>a</sup> John Terraine, **Business in Great Waters: The U-Boat Wars, 1916-1945** (Hertfordshire: Wordsworth, 1989, reprinted 1999), pp.772-773

<sup>b</sup> HMSO, **Navy Losses**, reprinted as **British Vessels Lost at Sea, 1914-18 and 1939-45** (Northamptonshire: Patrick Stephens, 1919, reprinted 1988), Section I, p.8.

<sup>c</sup> Stephen Roskill, **History of The Second World War: The Navy at War, 1939-1945** (London: HMSO, 1960), Vol.3, Part II, p.472.

<sup>d</sup> Stephen Roskill, **History of The Second World War: The Navy at War, 1939-1945** (London: HMSO, 1960), Vol.3, Part II, p.448.此處數字包含皇家海軍所操作的盟國艦隻與皇家海軍租借其他盟國的艦隻

<sup>e</sup> Robert E. Kuenne, **The Attack Submarine: A Study in Strategy** (New Haven: Yale University, 1965), p. 57.唯仍缺部分數據。

<sup>f</sup> Stephen Roskill, **History of The Second World War: The Navy at War, 1939-1945** (London: HMSO, 1960), Vol.1, p.602; Vol.2, p.474; Vol.3, Part I, p.375.

<sup>g</sup> Stephen Roskill, **History of The Second World War: The Navy at War, 1939-1945** (London: HMSO, 1960), Vol.2, p.474; Vol.3, Part I, p.375; Part II, p.471

Today, submarines are much improved. Many submariners believe that the best ASW asset against a submarine is another submarine. However, there is no combat experience to support such a claim after WWII. But one thing to be sure of is that submarines have been totally integrated as one of several platforms in joint ASW operations. For example, one U.S. carrier battle group needs an ASW screen of two or three SSNs. Submarines also play an important role in denying southward Soviet submarines at the GRIUK (Greenland-Island-United Kingdom) ASW barriers.

一般說來，先進的核動力攻擊潛艦方具有可信反潛能力，唯近年來傳統潛艦在科技上的突破，使得傳統潛艦在特定區域運用特定戰術亦將能發揮若干的反潛效能。目前傳統潛艦受制水下航速，除非以多艘接力部署的方式，否則仍很難能有效擔任一支快速運動的水面艦隊的反潛屏衛。而這意味只有五艘漢級核動力潛艦可以隨時提供來襲的中國艦隊近身的反潛防衛。但是傳統潛艦在匿蹤性上優於核動力攻擊潛艦，而且如果傳統潛艦躲在淺水水域以靜制動，高速伴護的核動力攻擊潛艦將

喪失其優勢。其次，由於中國傳統潛艦僅須短期間內即可到達作戰水域，其水面航行或呼吸管航行的時間都可以大為縮短，因此中國潛艦很可能採取一出港即行潛航的匿蹤方式，以加大其奇襲性，而我反潛的空中兵力與水面兵力都必須等它們抵達台灣附近水域時，才有偵測的機會。誠如前述，若我國能有若干前進部署的潛艦，它們可以扮演有限的戰術預警角色。當它們偵知得中國潛艦兵力異常的活動，可以迅速提供我方反潛兵力重要的預警情報，以便更有效與即時地展開反潛作戰的部署。而其他在海備便的我方潛艦，即使我方購進八艘新的潛艦，要擔任全部佈防於台灣鄰近水域，數量依舊不足，故應重點部署於中國潛艦容易滲透的重要水域，偵測出中國潛艦的滲透，並與反潛水面兵力與空中兵力擔任聯合獵潛任務。最重要的任務，將是防堵中國潛艦對我重要海軍基地進行突襲與佈雷。次要的任務，在台灣東北角水域與巴士海峽，擔任防止中國潛艦滲透的角色。前者，能增強我方水面艦隻第一擊存活度，後者，維繫東部戰時安全航道的安全。

Generally speaking, only advanced SSNs have reliable ASW capabilities. However, the SSKs technical breakthrough in recent years enables SSKs to have some ASW capabilities at specific areas by specific tactics. Under the limitation of SSKs underwater speed, unless deploying many boats in a relay-race method, SSKs can hardly provide an effective ASW screen for a fast-moving fleet. It implies that only five *Han*-class SSNs can closely escort the PLAN invading fleet at any time. But hidden third-generation SSKs, with a more stealthy performance, have a good chance of ambushing the speedy escorted SSNs, especially in the shallow waters. Moreover, because the PLAN SSKs can arrive at the operational area in a short period, their possible exposure on surface or snorkeling will be reduced. To exploit their stealthy elements in a surprise, they even probably dive all the way as soon as they put to sea. The ROCN ASW forces can only detect the PLAN infiltrating SSKs after they arrive in their operational area. As mentioned above, if the ROCN has some forward-deployed SSKs off the PLAN bases, they can play a limited early warning role. Once they detect the abnormal movement of the PLAN submarines and forward such a invaluable information to the ROCN ASW forces, the ROCN can deploy its ASW assets more effectively and timely. Even after the ROCN obtains eight new SSKs, the numbers of boats can ready at sea are still limited. Such limited submarines can hardly cover all waters in Taiwan's vicinity. Instead, they should deploy at the areas where PLAN submarines can easily infiltrate. Their jobs are to detect the enemy's infiltrating submarines and to co-operate with other surface/airborne ASW platforms to commence ASW operations. For these SSKs, their uppermost task is to deny the PLAN submarines from raid or minelaying off our naval bases; and the secondary task is to choke the infiltrating channels of PLAN's submarines, such as the northeastern waters and the Luzon Strait. The former aims at improving the first strike survivability of the ROCN surface fleet while the latter is the key to safeguard our safety route in the eastern waters.

依前述，我國潛艦所擔任攻擊性／防禦性佈雷、襲擾敵方艦隊行動與區域聯合反潛等任務，均是打擊武力價值取向的目標選定。與傳統的見解相反，作者認為以潛艦用之於打擊價值取向的目標選定上，並非合宜的作戰任務，其理由如下：

As outlined above, the first three operational concepts of the ROCN SSKs that the

authors suggest (offensive/defensive minelaying, interrupting the enemy's surface fleet actions, and joint area ASW), are all counterforce targeting orientation. Contrary to conventional wisdom, the authors believe that deploying the ROCN SSKs in a countervalue operation may not be sound. Our belief is based on the following grounds:

(一) 所謂打擊價值的目標選定，對於核動力彈道飛彈潛艦而言，是針對對方平民目標的核打擊，而對於傳統潛艦而言，主要是針對敵方的船運與商船。要干擾或封鎖敵方的海上交通，除了佈雷不讓敵方的商船進出敵方的港口外，至於對於已經航行在海上的商船，由於戰術上的考量，潛艦大多會採取擊沉的方式，而不是一般水面艦隻所能夠使用的捕獲。<sup>80</sup>因此，潛艦的商船戰，必然造成平民傷亡，而且極有可能波及中立國利益。我方一旦率先發動，不僅將代表戰爭的升級，更將招致國際間的抗議。而中國擁有升級主導權，可輕易藉由其他方式，針對我方的升級，再進一步的升級。因此，我方率先發動潛艦商船戰不僅徒給中國升級之藉口，一旦平民傷亡擴大，將愈使戰爭的降級與結束越為困難。

(1) For a SSBN, the countervalue targeting means a nuclear strike against the enemy's civilian targets. As for a SSK, such targeting will be mainly against the enemy's maritime traffic or merchantmen. Besides minelaying for preventing the enemy's merchantmen from using ports, the submarines, on the account of tactical considerations, usually will not try to prize the enemy's merchantmen that at seas, as the common practice of the surface warships, but to sink them.<sup>80</sup> Therefore, using submarine to conduct a commerce warfare will inevitably cause civilian casualties and damage the interests of the neutrals. If Taiwan chooses to initiate, it will mean not only escalating the war but also inviting protests from international community. Moreover, China holds the escalation dominance and is able to return a further and higher escalation easily in respond to Taiwan's initial escalation. Therefore, Taiwan's initiation of commerce warfare by submarines will not only give Chinese excuse of escalation, but when civilian casualties mount will also make de-escalation or ending hostility more difficult.

(二)若中國先對我商船攻擊時，我方是否應該針對中國商船進行報復或懲罰？一兩艘台灣的商船被擊沉，固然一時間尚不會帶來明顯的物資缺乏，不過卻能帶來承平既久的台灣社會重大的震撼。然而，即使台灣海軍立即展開報復或懲罰，就算可以擊沉十艘中國商船，這樣的震撼仍然不會復原，其所引起的國內政治效應很可能將持續發酵。我方能夠作的，是在政治上將這樣的震撼引向同仇敵愾並訴諸國際輿論的支持；在軍事上要能避免更多的商船被擊沉或痛擊來襲的中國船隻。將重要的戰略資產——潛艦用來打擊對中國影響有限的「軟性目標」，將是錯誤的分散兵力，反而影響護航與反擊作戰的能量。震撼，不會由加於施害者另一個震撼所彌補，只能在勝利中慢慢復原。

(2) If China strikes Taiwan's merchantmen first should we commence a retaliatory or punitive raid against Chinese merchantmen? One or two Taiwan's merchantmen being sunk will not bring about any significant shortage of material immediately, but it can deliver a grim shock to Taiwan's society that takes the peace for granted. However, even if the ROCN retaliates or punishes without delay, a sinking of ten more Chinese mer-

chantmen would still not recover Taiwan's society from such a shock nor can it stop the storm of domestic politics squalling. The best responses that Taiwan can take are, in the political aspect, directing such a shock to rally its people and to win international sympathy, while in its military efforts, preventing more merchantmen from being sunk and dealing with the PLAN attacking forces. It will be unwise to disperse our submarines, Taiwan's important strategic assets, on Chinese insignificant "soft targets" and to reduce our strength in escort and counterstroke. Shock will not be cured by shocking the enemy in return, it can only be slowly recovered by victory.

(三)對於像中國這樣的陸權國家，商船與對外海運並不是中國的戰略脆弱點，我方以高價值的潛艦加以攻擊並不合算。封鎖耗時，而且最後是不是能藉由封鎖拖垮中國軍事與經濟潛能也大有疑問。而且一旦台海發生衝突，即使我方不加襲擾，中國自上海以南的航運仍會受到一定程度的影響。姑無論中國的領導人如何評價其海上商運的可能影響，中國海軍仍可能無視於我方對其商船的攻擊，而在不被分散兵力的情形下加快攻台節奏，因為一旦攻台得逞，我方潛艦對其商運的威脅自然消失。

(3) To a land power such as China, merchantmen or maritime traffic is not its center of gravity. Therefore, it is not a cost-efficient option to use submarines, Taiwan's invaluable assets, against Chinese merchantmen. Blockade takes time. Also, it is questionable whether a blockade can wear off Chinese military and economic potential eventually. Moreover, once a military confrontation occurs in the Taiwan Strait, Chinese maritime traffic to the south of Shanghai will be more or less affected even without Taiwan's interruption. No matter how the Chinese leadership evaluates the inconvenience of their maritime traffic, the PLAN will probably ignore Taiwanese assaults on merchantmen, but rather speed up the tempo of the invasion without any dispersion. Once the invasion succeeds, Taiwanese submarine threats to Chinese maritime traffic are subsequently eliminated.

因此，在戰時，台灣潛艦作戰應針對敵人的軍事目標，最佳的方案是中和或癱瘓其出海作戰能力，其次是襲擾其已出海的艦隊之行動，再下是令其登陸作業困難重重。要知道：如果中國海軍無法迅速運載其地面部隊渡海登陸，並維持其地面作戰所需之補給，以征服台灣為目的的全面進犯將難以迅速達成，甚至於根本無法達成。以此來說服中國打消地面部隊犯台的念頭，防止戰爭持續升級。在這樣前提下，尊嚴地結束敵對狀態與營造可持久的和平之戰爭目標才有可能達成。

Therefore, in wartime, the ROCN submarine forces should concentrate on the enemy's military targets. The best option is to neutralize or paralyze the PLAN's capabilities to sail out to sea. Next it is to interrupt their fleet actions at seas. Finally, it is to make the PLAN's amphibious operations difficult. We have to bear in mind that the Chinese invasion can not succeed swiftly or even can not succeed at all if the PLAN can not unload landing troop across the Strait and maintain sustained logistics to support their ground operations. By such effects, Taiwan may dissuade the Chinese leadership from escalating and using a land force to invade Taiwan. Taiwan's war aims, to seek an honorable ending of hostility and to construct a sustainable peace, are only attainable under

such a condition.

除了前述作戰類型外，潛艦可在危機時擔任預防性部署的任務。對於中國近接海軍武力展示，我方可派出潛艦加以監控。這種危機時的預防性部署將較之水面艦隻的直接對壘，更能符合我「不挑釁、不示弱」的危機處理原則。而且這也是風險較小的選項，不僅潛艦為敵方偵測到的機率亦較低，以第三代潛艦的攻船戰力而言，將能對中國進一步的升級行動，產生嚇阻或有所因應。此一能力，將可以大大降低中國對發動近接海軍武力展示的成本與風險的可控制性，產生其不為是項舉動的動機。

Besides the above operational concepts, submarines can be used in a crisis as a role of preventive deployment. The ROCN can dispatch submarines to monitor the Chinese impending shows of naval force. Compared with the head-on confrontation between surface warships of two navies, such a preventive deployment in crisis would be much more in accordance with Taiwan's principles of "no provocation, no signs of weakness" in crisis management. Moreover, it would be a relatively risk-averse option because not only the chance of being detected by the enemy's ASW forces is low but also, in the terms of the anti-ship capability of a third-generation SSK, we could deter the PLAN fleet from a further escalation or respond it immediately. By this capability, China could no longer have the controllability of costs and risks in impending shows of force, and could therefore produce a motive of avoiding such a venture.

## 結語 Final Thought

一九四一年九月間在辯論如何嚇阻日本參戰的激烈辯論上，英國外相艾登這樣說：

從嚇阻日本參戰的角度上，派遣一艘現代化的戰艦——像是威爾斯王子號——到遠東來，將比起部署一大堆第一次大戰的老船具有更明顯的政治效果。如果，派遣威爾斯王子號自開普敦向遠東開來，這樣調動的消息將會很快就傳到日本，而從那一天起，就產生了嚇阻的效果。<sup>81</sup>

In the sharpened debate of how to deter Japan from entering the war in September 1941, British Foreign Secretary Eden argued:

From the point of view of deterring Japan from entering the war, the despatch of 1 modern ship, such as the Prince of Wales, to the Far East would have far greater effect politically than the presence in those waters of a number of the last war's battleships. If the Prince of Wales were to call at Cape Town on her way to the Far East, news of her movement would quickly reach Japan and the deterrent effect would begin from the date.<sup>81</sup>

三個月後，在馬來半島外海，威爾斯王子號與它的僚艦卻敵號在兩個小時內被日軍所擊沉。英軍損失了兩艘戰艦，而日軍只付出了八架戰機。

Three months later, off the Malaya Peninsula, HMS *Prince of Wales* and its company HMS *Repulse* was sunk by the Japanese within two hours. To destroy the two battleships cost the Japanese only eight aircraft.

對政治人物而言，說哪項武器是嚇阻武力，總是容易的。但對於軍人而言，這需要許多的努力，並經由勞心勞力後方能達致。單憑軍事手段當然不能達致嚇阻，任何的嚇阻也都有失敗的可能，然而，如果沒有軍事上的充分準備，嚇阻失敗的結果將會更為痛苦。儘管敵手也不盡然必會利用軍事上的「機會之窗」，<sup>82</sup>但是，軍事力量有其政治性的效應，當敵手的優勢越過一定門檻，真正發動戰爭便不一定是其達成其政治目的的必要手段。

For statesmen, saying that a given weapon as deterrent is relatively easy. However, to airmen, soldiers or sailors, it will need more effort and this always comes after painstaking training and brainwork. Deterrence, of course, can not be achieved by military means alone. Deterrence can fail. Without sufficient military preparation, the consequence of deterrence failure will be much bitterer. The opponent may not launch an invasion by jumping through the "windows of opportunity".<sup>82</sup> However, military might has its political influence. After the enemy's superiority exceeds a certain threshold, he can press home his political ends even without a real war.

潛艦，在適切的作戰概念指導下，正可以發揮這兩種嚇阻效果：一方面藉由潛艦所具有的第二擊能力，由降低我方在第一擊的損害，降低敵方遂行第一擊的誘因。另一方面，則藉由潛艦在台海水域中的天然優勢，加高「機會之窗」的門檻，使中國無法自信其能藉由實際用武與威脅用武來達成政治目標。而要支援這樣的潛艦作戰概念，本文在最後提出幾項建議：

Submarines, under the guideline of proper operational concepts, can achieve precisely two deterrent effects. On one hand, by the second strike capabilities that submarines provide, Taiwan can lessen its damage under Chinese first strike, therefore reducing Chinese incentive to strike first. One the other hand, by the submarine's natural advantage in Taiwan's vicinity, Taiwan can maximize the threshold of "windows of opportunity" and deprive the Chinese of the confidence that it can use force or the threat of force to achieve its political ends. In order to support such a submarine operational concept, the authors suggest some recommendations:

在國外，潛艦兵力在建軍上的困難，通常來自文武領導階層的忽視，特別是來自海軍其他兵種（如水面艦隊與航空兵）的抵制。不過值得慶幸的是，我國並不存在這樣的問題。潛艦兵力的籌建，向來備受重視。前任李登輝總統與現任陳水扁總統均曾對來訪德國議員表達我方對於德製二〇九型潛艦的濃厚興趣，由國家領導人針對特定武器公開「拜託」的例子，大概只有潛艦。歷任海軍總司令對於潛艦的獲

得一直抱持高度期待，對於潛艦的潛能也多所認識，現任海軍總司令李傑將軍，更是潛艦老兵。而當今年美國軍售案具體項目陸續公開後，最獲朝野共識支持的大概也是潛艦。

In other countries, the obstacles in construction of submarine forces often come from the ignorance in politico-military leadership, especially those from other aims in the navy (surface fleet or air arms). Fortunately, it is not the case in Taiwan, whose government fully recognizes the importance of submarine forces. Both the former President, Lee Teng-hui and the current President, Chen Shui-bian, expressed Taiwanese interests in German 209-class submarine in the front of the visiting German congressmen. No other naval weapons or systems have ever attracted Taiwan's civilian leadership so much in the past two decades. All successive Commanders-in-Chief of the ROCN wish to obtain submarines and appreciate the potential of submarine warfare. The current Commander, Admiral Lee Jei, was a veteran skipper. Furthermore, when the detailed items in the package of the arms sales of year 2001 had come to surface, the most undisputed one perhaps was the procurement of eight SSKs.

台灣最大的問題是潛艦的取得來源，雖然在本次軍售中獲得美國同意協助我國取得，但一般的質疑在於美國本身已不製造傳統潛艦，而其他具有生產傳統潛艦的國家又很容易在中國的壓力下拒絕為我國建造潛艦或提供製造藍圖給我國。但八艘傳統潛艦的採購畢竟是西方武器製造商的大事，連俄羅斯都表示相當興趣，<sup>83</sup>在美國的背書下，我國從第三國獲得並非全無可能。而美國本身在第三代傳統潛艦的若干關鍵技術的發展過程中，一直保持密切的接觸，專為我國起造的可能亦無法排除。因此，除了外交上的努力與軍購作業的防弊外，未來的重點將是我們需要怎樣的潛艦。誠如前述，傳統潛艦的科技水準在近年獲得相當的突破，因此，我國若不能購進第三代水準的傳統潛艦，可能不要三十年（一般潛艦的壽限）就得提前除役。我們所需的第三代傳統潛艦除了應有先進的船體、戰鬥系統、聲納設備與電子支援系統外，更應根據前述作戰概念而具有下面的性能：絕氣推進系統、水下發射攻船飛彈、情報偵蒐能力、密集佈雷能力。

For Taiwan, the most difficult problem is the source of submarine acquisition. Although the U.S. had agreed to assist Taiwan in obtaining eight SSKs, some questioned its possibility since the U.S. no longer manufactures SSKs and other SSK-manufacturing-capable states may refuse to build SSKs or to provide the blueprints to Taiwan for fear of Chinese pressure. However, partly because the eight SSKs procurement is big business for the Western submarine manufacturers, including the Russians,<sup>83</sup> and partly because of American endorsement, it is not impossible for Taiwan to obtain eight SSKs from a third state. Moreover, since the U.S. keeps close contact with the progress of some key technologies of third-generation SSKs, it can not rule out the possibility that the U.S. will build the SSKs specially for Taiwan. Therefore, besides our diplomatic efforts and accountability of the oncoming procurement process, our focus in the future should be on the question of what kind of SSKs we want. As mentioned above, the technological levels of SSKs have had some significant breakthroughs in recent years. Thus, if Taiwan can not obtain third-generation SSKs, the life span of the boats will not last thirty years, the general life span of a submarine. Taiwan's requirements for

third-generation SSKs are that they should not only have an advanced hull, combat systems, sonar systems, and ESM. According the operational concepts that the authors suggested, the specifications of the Taiwan's new submarines should also include: the capabilities of AIP, submerged launch anti-ship missiles, intelligence gathering, and dense minelaying.

其次，人員素質影響反潛作戰與潛艦作戰甚鉅。前面已經提到：偵潛工作不僅是費時費力，並需要有專業人員保持警覺。而潛艦作戰，需要有更高素質的官兵以達成任務。在平時要保持潛艦的匿蹤性並防制敵人的突襲，潛艦必須有比水面艦隻更多的時間在海上值勤。而潛艦操作本來就極富挑戰性，一不留神，就會釀成災禍。到了戰時，潛艦更須在反潛兵力的層層攔阻下執行任務，風險極高。因此，如果沒有訓練極佳的潛艦官兵，平時就無法發揮潛艦作為第二擊的潛力，戰時更難安全地達成任務。<sup>84</sup>從我國海軍其他水面艦隻的換裝經驗看來，人員的素質與數量也將會是我國在潛艦兵力擴充之際的最大問題。目前海龍級潛艦艦上官兵約六十餘人（軍官八名）。高度自動化之第三代潛艦，雖可大幅降低艦上冗員，每艘潛艦僅須三十餘員官兵操作，但同時士官的比例一般亦提高至二分之一左右，且須由高度專業士官擔任。易言之，我國經短期培訓掛階的義務役士官，將很難符合現代化潛艦之需求。而且若欲增加潛艦在海的嚇阻效果，勢必採取一般西方國家潛艦所採用的兩班官兵輪流值勤。而這意味我國新購進八艘潛艦後，將立即需要近三百名專業士官。以目前（民國九十年五月）海軍士官缺員數達六千餘員（含志願役與義務役）的窘狀，<sup>85</sup>此一問題，海軍勢必得迅速解決。

Second, the ASW and submarine operations are deeply influenced by the quality of operators. As mentioned above, the ASW is a time-consuming and laborious task, and therefore needs a qualified and alert crew. Submarine operations require a more qualified crew to achieve their tasks. Compared to surface warships, submarines need to spend more time at sea in order to maintain their stealth and prevent the enemy's surprise. Operating a submarine, by nature, is a challenging job. Even the slightest error can cause disastrous incidents. When war comes, submariners always need to implement their mission under the enemy's defensive layers. The risk is high. Therefore, without competent submariners, the second strike potential of submarines can not be brought into full play in peacetime, nor can it achieve the required missions without loss in wartime.<sup>84</sup> From the experiences when the ROCN experienced the modernization of its surface fleet a decade ago, the quality and quantity of competent crews will be the most serious problem for the ROCN to expand its submarine forces. The complement of the ROCN *Hailung*-class SSK is some sixty members approximately (eight officers). Although a third-generation SSK needs only some thirty crew to operate, but the ratio of non-commission officers (NCOs) generally increases to fifty per cent and most of them are professional NCOs. In other words, it is questionable whether most of the ROCN enlisted NCOs, who are short of experience and training, can match the requirements of an advanced third-generation SSK. Moreover, for increasing the deterrent effects of the presence of submarines at sea, a double crew system, as most Western navies adopt, may be needed. If so, it means that the ROCN needs some three hundred professional NCOs before the eight SSKs come into service. Considering the lack of NCOs in the ROCN has now (May 2001) reach some six thousands (including volunteer NCOs and

enlisted NCOs),<sup>85</sup> the ROCN must cope with this drawback without delay.

第三，戰鬥空間的知識對於潛艦作戰至為重要。海水特性與水下地形是反潛兵力的天敵，也是潛艦要發揮其匿蹤性達成任務的憑藉，更是潛艦戰術研究的出發點。對這些戰鬥空間的研究，不僅僅從反潛的角度，從潛艦作戰的角度去看此一問題在未來將更為需要。

Third, the knowledge of battlespace is critical for submarine operation. The characteristics of seawaters and underwater topographic conditions are natural enemy to ASW forces as well as the stealth of submarines depends on and the starting points of research the submarine tactics. The studies of the battlespace can not be from an ASW perspective solely, from now on, the perspective of submarine operations will be much needed.

第四，海水構成基地與水下潛航潛艦通訊上的困難。而且欲增加嚇阻的效度，潛艦不僅在海潛航的時間要長，而且可能在無戰備提升的預警情況下隨時準備執行任務。因之，除了在不損及潛艦匿蹤性的前提下，維繫基地對潛艦行縱的掌握外，更應針對潛艦建立適切的接戰規則。而這些規則，應隨任務的政治敏感性，有所區別。

Fourth, the seawaters obstruct a smooth communication between a submerged submarine and its base. Moreover, in order to increase the effectiveness of deterrence, a submarine will stay in underwater as long as it can as well as ready for action even without any warnings from increasing the level of readiness. Thus, the base should keep contact with its submarines while not to jeopardize their stealthy characteristics. More importantly, the Navy should establish a set of ROE, which are especially designed for the submarine forces. These ROE should be differentiated by the political sensitivity of the missions.

最後，另一個深刻的問題是：海權的建立，不能單單靠海軍的力量。台灣本身在海權上的脆弱性若如果不能改善，而只是把問題全丟給海軍，那將是耗資極高的選項。台灣依賴海上交通固不能免，但要改善它的脆弱性並非全無空間。台灣文人領導階層固然充分瞭解，台灣海運極可能為敵所襲擾，需要有強大的海軍來加以保護。但與此同時，是否有人關心過：如何能抒解海上運輸過度集中在西岸港口的潛在危險？東岸兩處戰略要港有無相當的經營？一遇封鎖，國輪有無由較為安全東部水域進出的緊急航線計畫？油輪有無在東部海岸卸油的準備？當這些問題的答案全是否定的時候，再強大的海軍還是會很快地達到其極限之處。■

Finally, a profound issue is that the establishment of sea power can not count on the navy alone. If Taiwan's vulnerability in terms of sea power can not be improved comprehensively, but rather throwing all the burdens to the ROCN, it will be a costly option. Taiwan must rely on maritime traffic, but it does not mean there is no rooms for improving its vulnerability. Although Taiwan's political leadership fully acknowledges that Taiwan's maritime traffic can be easily interrupted by the enemy and we therefore need a strong navy. But, at the same time, have we ever raised the following questions to ourselves: how could we moderate the over-concentration of shipping in the western

ports? Will the two eastern ports be capable of receiving the mass shipping in wartime? Do Taiwanese merchantmen have any contingency plans to use the eastern approaches if we are blockaded? Do Taiwanese tankers have any preparations to unload off the eastern coast? If the answers of these questions are all negative, a strong navy will soon find its limits. ■

## 註釋

### Reference

- <sup>1</sup> Edward N. Luttwak, **Strategy: The Logic of War and Peace** (Massachusetts: Harvard University Press, 1987), p.191.
- <sup>2</sup> Patrick M. Morgan, **Deterrence: A Conceptual Analysis** (Beverly Hills: Sage, 1977, reprinted 1983), p.19.
- <sup>3</sup> 以上的陳述，特別適用於傳統嚇阻的情狀中，「傳統嚇阻與軍事戰略——或更明確地說——與一國武裝力量如何運用以達成特定的戰場目標具有直接的關連。」見：John J. Mearsheimer, **Conventional Deterrence** (Ithaca: Cornell University Press, 1983), p.28.
- <sup>4</sup> 參見：A.J.P. Taylor, **The First World War** (London: Penguin, 1963, reprinted 1966), pp.74-76, 169-171.
- <sup>5</sup> Owen Cote and Harvey Sapolsky, **Antisubmarine Warfare after the Cold War** (Cambridge: MIT Security Studies Program, 1997), p.11.
- <sup>6</sup> 二次大戰之初，希特勒為避免觸怒中立的美國並希望英國謀和，曾下令德軍潛艦不得攻擊商船。見 John Terraine, **Business in Great Waters: The U-Boat Wars, 1916-1945** (Hertfordshire: Wordsworth, 1989, reprinted 1999), pp.215-217. Dan van der Vat, **Stealth at Sea: The History of Submarine** (London: Orion, 1994), pp. 182-185。一九八二年英軍潛艦攻擊阿根廷巡洋艦貝爾格蘭諾將軍號（General Belgrano）的決定，乃經相關內閣高層討論後，由首相柴契爾夫人（Margaret Thatcher）下令。見：Max Hastings and Simon Jenkins, **The Battle for the Falklands** (London: Book Club, 1983), pp.147-149。
- <sup>7</sup> Wayne P. Hughes Jr., "Naval Tactics and Their Influence on Strategy," **Naval War College Review**, Vol.XXXIX, No.1 (1986), p.4.
- <sup>8</sup> 《孫子兵法》謀攻篇。English translations see Sun-Tzu, **The Art of War**, Translated by Ralph D. Sawyer (New York: Barnes & Noble, 1994), p.177.
- <sup>9</sup> 有關嚇阻（deterrence）與脅迫（compellence）的基本界定，見：Robert J. Art, "Four Functions of Force," in Robert J. Art and Kenneth N. Waltz ed., **The Use of Force: Military Power and International Politics** (Lanham: University Press of America, 1993), 4<sup>th</sup> edition, pp.4-6.
- <sup>10</sup> Lawrence Freedman, "Military Power and Political Influence," **Journal of International Affairs**, Vol.74, No.4 (1988), p.767.
- <sup>11</sup> Paul Seabury and Angelo Codevilla, **War: Ends and Means** (New York: Basic Books, 1990), p.244.
- <sup>12</sup> 其他有關中國領導人對武力犯台的措辭，見：行政院新聞局，《對中共所謂不排除使用武力犯台的研析》（台北：行政院新聞局，民國八十五年）。
- <sup>13</sup> A useful theoretic analysis can be seen in Fred C. Ikle, **Every War Must End** (New York: Columbia University Press, 1971), especially chapter five.
- <sup>14</sup> The detailed descriptions of each strategy can be seen in Alexander L. George, "Strategies for Crisis Management," in Alexander L. George ed., **Avoiding War: Problems of Crisis Management** (Boulder: Westview Press, 1991), pp.379-383.
- <sup>15</sup> 中國對台使用核電磁脈衝攻擊的想定，可見：鍾堅，〈共軍高技術犯台戰爭的準備：如何以戰逼降〉，《國防政策評論》，第一卷，第一期，頁一五八至一六一。
- <sup>16</sup> 決戰的意義依目前官方文件與學者論述，仍未有明確界定。不過，國軍將決戰稱為「決定性的會戰」，會戰是「大部隊在戰場上的交戰行動」，見國防部，《國軍軍語辭典》（台北：國防部，民國六十二年），頁九。並參見：Edward N. Luttwak and Stuart L. Koehl, **The Dictionary of Modern War** (New York: Gramercy Books, 1991), p.81.
- <sup>17</sup> Brian Bond, **The Pursuit of Victory: From Napoleon to Saddam Hussein** (Oxford: Oxford University Press, 1996), pp.4-5.
- <sup>18</sup> 前參謀總長郝柏村舉「戰略持久」之要領如下：「保存戰力、以最少的犧牲換取最大代價、避免早期決戰、選定有利決戰時機」。見：郝柏村，《八年參謀總長日記》（台北：天下文化，民國八十九年），上卷，頁二三八。
- <sup>19</sup> David A. Shlapak, David T. Orletsky, and Barry A. Wilson, **Dire Strait? Military Aspects of the China-Taiwan Confrontation and Options for U.S. Policy** (Santa Monica: RAND, 2000), pp.27-28.
- <sup>20</sup> 有限戰爭在目的、手段、地緣、使用武器或目標選定上的限制，見：Robert E. Osgood, **Limited War: The Challenge to American Strategy** (Chicago: University of Chicago Press, 1957), pp.237-250.
- <sup>21</sup> Hedley Bull, "Sea Power and Political Influence," in Jonathan Alford ed., **Sea Power and Influence: Old Issues and New Challenges** (Hampshire: Gower Publishing Company, 1980), p.8.
- <sup>22</sup> Kenneth Macksey, **The Penguin Encyclopedia of Weapons and Military Technology: From Prehistory to the Present Day** (London: Viking, 1993), p.60.
- <sup>23</sup> Milan N. Vego, **Naval Strategy and Operations in Narrow Seas** (London: Frank Cass, 1999), pp.156-157, 237.

- <sup>24</sup> Geoffrey Till, **Modern Sea Power: An Introduction** (London: Brassey's, 1987), p.59.
- <sup>25</sup> Vego, **Naval Strategy and Operations in Narrow Seas**, p. 242.
- <sup>26</sup> 有關懲罰與報復的分野，可見：James J. Wirtz, "Strategic Conventional Deterrence: Lessons from the Maritime Strategy," **Security Studies**, Vol.3, No.1 (1993), pp.121-122.
- <sup>27</sup> Thomas C. Schelling, **Arms and Influence** (New Haven: Yale University Press, 1966), chapter 1.
- <sup>28</sup> 以下航運數據見交通部，《交通統計月報民國九十年二月》（台北：交通部，民國九十年）。
- <sup>29</sup> 以上油品數據均由中油公司提供。
- <sup>30</sup> Michael S. Lindberg, **Geographical Impact on Coastal Defense Navies: The Entwining of Force Structure, Technology and Operational Environment** (Hampshire: Macmillan, 1998), p.46.
- <sup>31</sup> Harold J. Kearsley, **Maritime Power and the Twenty-First Century** (Aldershot: Dartmouth, 1992), p.11.
- <sup>32</sup> Michael O'Hanlon, "Why China Cannot Conquer Taiwan," **International Security**, Vol.25, No.2 (2000), p.76. David Shambaugh, "A Matter of Time: Taiwan's Eroding Military Advantage," **Washington Quarterly**, Spring 2000, p.131.
- <sup>33</sup> Richard Shape ed., **Jane's Fighting Ships, 1999-2000** (London: Jane's, 1999), pp. 115-118.
- <sup>34</sup> 有關中共海軍對「破交」、「襲港」與「封鎖」的作戰準備與構想，可參見：陳訪友編，《海軍戰役學教程》（北京：國防大學出版社，一九九一年），第八、九、十一章；或黃彬編，《十種作戰樣式的作戰指揮》（北京：國防大學出版社，一九九七年），第三章。
- <sup>35</sup> William Jameson, **The Most Formidable Thing: The Story of the Submarine from Its Earliest Days to the End of World War I** (London: Rupert-Hart-Davis, 1965), p.227.
- <sup>36</sup> J. Richard Hill, **Anti-Submarine Warfare** (Annapolis: Naval Institute Press, 1984, reprinted in 1993), pp.44-52.
- <sup>37</sup> W. J. R. Gardner, **Anti-Submarine Warfare** (London: Brassey's, 1996), pp.1-2. Vego, **Naval Strategy and Operations in Narrow Seas**, pp.43-44.
- <sup>38</sup> Correlli Barnett, **Engage the Enemy More Closely** (London: Penguin, 1991, reprinted 2000), pp.263-264. John Ter-raine, **Business in Great Waters: The U-Boat Wars, 1916-1945** (Hertfordshire: Wordsworth, 1989, reprinted 1999), pp.337, 344-345.
- <sup>39</sup> Vego, **Naval Strategy and Operations in Narrow Seas**, p. 11.
- <sup>40</sup> Shlapak, Orletsky, and Wilson, **Dire Strait?**, p. 30.
- <sup>41</sup> 有關「陸基洋面支援」概念的闡釋，可見：翟文中，《台灣生存與海權發展》（台北：麥田出版社，民國八十八年），頁一五九至一六六。
- <sup>42</sup> P. J. Gates and N. M. Lynn, **Ships, Submarines and the Sea** (London: Brassey's, 1990), pp.80-81.
- <sup>43</sup> 海象數據由中央氣象局提供。
- <sup>44</sup> 有關淺水區域對反潛作戰的限制，參見：Martin Edmonds, **ASW in Coastal Waters: A New Challenge** (Lancaster: CDISS, 1999), pp.20-23.
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- <sup>46</sup> 《中國時報》，八十三年六月五日。
- <sup>47</sup> Shlapak, Orletsky, and Wilson, **Dire Strait?**, p. 22.
- <sup>48</sup> 有學者主張：中國海軍可將台海水域「區分為二十七個獨立區域，每區長寬約五十公里，由一艘潛艦負責，如此可以截斷台海四周內外交通，阻絕一切進出口貿易或外援。」見：陳福成，《防衛大台灣》（台北：金台灣出版公司，民國八十四年），頁二一八。
- <sup>49</sup> 由於高雄與左營距離甚近，封鎖的潛艦可能不需要集中到六艘。
- <sup>50</sup> 見本期劉和謙將軍專訪。
- <sup>51</sup> Gardner, **Anti-Submarine Warfare**, chapter 6.
- <sup>52</sup> Quoted in Holger H. Herwig, "Innovation Ignored: The Submarine Problem – Germany, Britain, and the United States, 1919-1939," in Williamson Murray and Allan R. Millet ed., **Military Innovation in the Interwar Period** (Cambridge: Cambridge University Press, 1996), p.246.
- <sup>53</sup> Karl Doenitz, **Memoirs: Ten Years and Twenty Days**, translated by R. H. Stevens (London: Cassell, 1958, reprinted 2000), p.23.
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- <sup>55</sup> Antony Preston, **Submarine Warfare: An Illustrated History** (San Diego: Thunder Bay, 1999), p.136.
- <sup>56</sup> Preston, "Stealthy Submarines and ASW," pp.67, 70.
- <sup>57</sup> 溫在春，「精進反潛作戰之研究」，頁七三。
- <sup>58</sup> Owen Cote and Harvey Saposky, **Antisubmarine Warfare after the Cold War** (Massachusetts: MIT Security Studies Program, 1997), p.4.
- <sup>59</sup> Quoted in Barnett, **Engage the Enemy More Closely**, p.219.
- <sup>60</sup> Max Hastings and Simon Jenkins, **The Battle for the Falklands** (London: Book Club, 1983), p.129.
- <sup>61</sup> Stan Zimmerman, **Submarine Technology for the 21st Century** (Victoria: Trafford, 2000), p.35.
- <sup>62</sup> Preston, **Submarine Warfare**, pp.64-66.; Zimmerman, **Submarine Technology for the 21st Century**, p.36.
- <sup>63</sup> Zimmerman, **Submarine Technology for the 21st Century**, p.14.

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- <sup>64</sup> Norman Friedman, "Littoral Anti-Submarine Warfare: Not as Easy as It Sounds," **International Defense Review**, Vol.28, June 1995, pp.54-55.
- <sup>65</sup> Antony Preston, "Submarine Modernisation Programmes," **Naval Forces**, Vol.XIII, No.III (1992), pp.39-40. Zimmerman, **Submarine Technology for the 21st Century**, pp.44-48.
- <sup>66</sup> 詳見：Joris Janssen Lok, "Royal Thai Navy Submarine Program," **International Defense Review**, Vol.28, June 1995.
- <sup>67</sup> 詳見：Antony Preston, "Sumarine Weapony," **Naval Force**, Vol.XIV, No.2 (1993).; Zimmerman, **Submarine Technology for the 21st Century**, pp.143-146, 149-153.
- <sup>68</sup> 《孫子兵法》軍形篇。English translations see Sun-Tzu, **The Art of War**, Translated by Ralph D. Sawyer (New York: Barnes & Noble, 1994), p.183.
- <sup>69</sup> 《孫子兵法》謀攻篇。English translations see Sun-Tzu, **The Art of War**, Translated by Ralph D. Sawyer (New York: Barnes & Noble, 1994), p.178.
- <sup>70</sup> Michael M. Tsai, "Introduction: Researching Taiwan's Future Defense," in Michael M. Tsai and Martin Edmonds ed., **Defending Taiwan** (London: Curzon Press, 2001).
- <sup>71</sup> 例如：翟文中，《台灣生存與海權發展》，頁一〇七至一〇八、一六〇至一六一。其他類似見解，有：Shlapak, Orletsky, and Wilson, **Dire Strait?** pp.41-42.
- <sup>72</sup> Bernard Brodie, **A Guide to Naval Strategy** (New Jersey: Princeton University Press, 1944), p.94.
- <sup>73</sup> 一般潛艦可攜帶之水雷數為可攜帶魚雷數的兩倍，唯為防萬一，通常執行佈雷潛艦仍會保留兩枚魚雷應變。我國海龍級潛艦據國外資料可攜帶二〇枚魚雷，國內有報導指出可攜帶二十八枚，此處從前者，每艘海龍級潛艦執行佈雷任務時，應可攜帶三十六枚水雷與二枚魚雷。見：Shape ed., **Jane's Fighting Ships, 1999-2000**, p. 680. 與《聯合晚報》，民國八十九年六月二十二日。古比級潛艦可攜帶之魚雷數，約在十四至十六枚左右，執行佈雷時，應可攜帶二十四枚至二十八枚水雷。
- <sup>74</sup> 以上數據出自：Shape ed., **Jane's Fighting Ships, 1999-2000**, pp. 132-133.
- <sup>75</sup> Antony Preston, "Submarine Systems," **Naval Forces**, Vol.X, No.IV (1989), p. 80.
- <sup>76</sup> David Foxwell, "Sea Mines and Minelaying," **International Defense Review**, Quarterly Report No.3 (1996), p.14.
- <sup>77</sup> Quoted in Alan Hinge, "Mine Warfare and Mine Countermeasures," in Dick Sherwood eds., **Operational and Technological Developments in Maritime Warfare: Implications for the Western Pacific** (Canberra, Strategic and Defence Studies Center, Australian National University, 1994), p.64.
- <sup>78</sup> 以上數據出自：Shape ed., **Jane's Fighting Ships, 1999-2000**, pp. 114-129, 679-687.
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- <sup>81</sup> Quoted in Barnett, **Engage the Enemy more Closely**, pp.397-399.
- <sup>82</sup> 「機會之窗」為「在一定期間內一個國家比起另一個國家擁有明顯的軍事優勢」。見：Richard N. Lebow, "Windows of Opportunity: Do States Jump through Them?" **International Security**, Vol.9, No.1 (1984), p.147.
- <sup>83</sup> Wendell Minnick and Robert Karniol, "Russians Talk Subs with Taipei," **Jane's Defense Weekly**, 20 June, 2001, p.35.
- <sup>84</sup> 二次大戰期間美軍有二百六十艘潛艦服役，損失了五十二艘，比例高達二〇%，但是比起蘇聯的五二%、日本的六八%、德國的九四%，美軍的損失在各主要交戰國間還算是比例較低的。而且潛艦官兵傷亡比例往往高過其他軍（兵）種。二次大戰期間，美軍有一萬六千餘名潛艦官兵出海執行任務，陣亡四千餘人，比例為二二%；德國有四萬餘名官兵服役潛艦戰隊，陣亡二萬五千餘名，比例更高達六三%。然而，第一次大戰，四%的德國服役潛艦擊沈三〇%的盟軍船隻，五・五%的艦長擊沈了六〇%的盟軍船隻。第二次大戰，二五%的美軍潛艦艦長擊沈了七五%的軸心國船隻，二・五%的德軍潛艦艦長擊沈了二五%的同盟國船隻。這樣的數據除了說明絕大部分的戰績來自於潛艦戰隊中極少數的菁英外，而且對於潛艦官兵而言，呈現出特別的學習循環，他們很難能從失敗中學習，因為潛艦一旦被擊毀，艦上官兵常因逃生不易而全員陣亡，倖存者大多也成為戰俘。因此，在一場長期的消耗戰中，當戰前訓練水準最高的潛艦官兵損失殆盡之後，戰績往往直線下滑，傷亡也會非比例性地增高。德軍在一九四二年八月前可維持擊沈二〇・五艘同盟國船隻而自己損失一艘潛艦的比例，但之後，比例滑落到一・七：一（其他各國的比例為：美國 23:1，英國 9.3:1，蘇聯 1.5:1，德國平均為 1.7:1）。數據見：Zimmerman, **Submarine Technology for the 21st Century**, pp.1, 6.; Dan van der Vat, **Stealth at Sea: The History of Submarine** (London: Orion, 1994), pp.139, 355-356.
- <sup>85</sup> 數據由國防部提供。