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NAVY CLASSIFICATION: PROPOSAL FOR A COMPARATIVE METHODOLOGY

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Introduction

One of the major difficulties that navy analysts face in the present relates to classifying war navies around the globe based on their relative power. Being a relative comparison, which parameters to consider in the analysis? How to define which combat means would be more powerful? Some comparisons are more evident and easy-taking. We know that an aircraft carrier with its boarded aviation group is more powerful than a coastal patrol-boat. Another easy example is an attack submarine nuclear-powered facing a supply ship. The chances of the last surviving are minimal. Other comparisons, however, require more care. Between a modern destroyer with sensors and missile systems and an old destroyer equipped only with cannons, the logic makes us think that the first has a bigger survival chance, due the technology and response capacity. However, in special occasions, this logic may be questioned, in example in internal waters, where the more powerful one is surprised, still in cruise route.

For means with similar capacities the comparison already gets complicated. Which would be more powerful, a modern frigate with high-end technology or an attack submarine nuclear-powered from the 1990's, or even a conventional submarine with modern technology? Other factors must be considered, not only the technology and number of conflicting actors. This

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confrontation is impacted by geography, training level and other subjective factors that are difficult to evaluate.

Raising the sample universe, when related to the comparison between war navies, which variables should be considered? Would the number of assets be enough to indicate the most powerful navy? For instance, a 100 patrol-ship navy is stronger than one with 10 destroyers? These questions still become more serious when one considers the issue of a given country being able to design and build its own combat capabilities, to be able to possess a higher technology aggregated to the shipbuilding sector, to dispose of more financial resources for the preparation and use of its war ships for achieving its missions, and, finally, the capacity to train the crew that guard its combat assets. Would the naval tradition also be a factor to be considered? Without these definitions, and if possible, without some relative measures, the comparison gets even more problematic.

The purpose of this research is to establish parameters that can be compared, having as sample the number and capacities published in journals and official documents of war navies present in activity. How to classify these navies regarding their combat power? How to set up a relative ranking of combat navies using tools that can be collected on those sources (publications and journals of general access) for a general classification in accordance with their relative power? This is the major problem developed by this research. When defining these parameters we can track down the evolution of a given naval power in the region that is being studied and in which way it is occurring. In the case of the "Pró-Defesa" Project, in which the security and scenarios are established in the Americas, this methodology would be able to contribute for the analysis of naval scenarios and comparative processes of regional naval forces. The relevance of such methodology is evident when we rank naval powers in accord to their relative power between themselves in a given geographical power space involving the sea.

Currently in the digital universe some sites that specialized in classifying war navies are available and in this case the Coast Guards are not included, within a ranking of relative power between the countries surveyed. The main digital rating agency is the Global Firepower (GFP) which at its specialized site https://www.globalfirepower.com[3] indicates the 110 most relevant navies at the present time.

This GFP initiative has been widely referred both in the military and academic milieus as a site with credibility and permeation in the defense area. In spite of its importance, some incongruities can be easily perceived. The

3 Accessed June 8, 2018.

most important one is that navies are classified in relation to the number of warships, which introduces considerable distortions in the comparative assessment between the armed forces. As an example, the classification of the US Navy, which is known to have the greatest absolute and relative power among its peers, is listed in third place, behind North Korea and China, which have a higher number of assets, if confronted with the American. Ship types, retaliatory capacity, nuclear weaponry and equipment, industrial and financial capacity are not considered, among other factors that must be taken into account when confronting ships and squadrons with similar or at least similar tasks.

Some relevant scholars in the academic world also sought to classify the navy according to their geographical scope and power projection capacity. The first to do so was Michael Morris (1988) who proposed in 1985 a nautical typology to distinguish the so-called third-world naval forces or medium naval forces that would differentiate themselves from those of the "developed" world with larger naval powers. Thus, it reached six levels of naval power, distinguishing regional, subregional, for area defense, coastal, surveillance and symbolic navies, using quantitative factors. A relative rank of power has never been established among the war navies.

The ranking established by Eric Grove (1990) has also been very referenced. He relied in part on Michael Morris's classification and thus established a ranking of navies with nine levels, however such a classification was based only on the "perception" of the author without distinguishing them comparatively. This is a qualitative analysis without comparative classification and without the establishment of quantitative factors.

Another classification without considering the comparison between navies is that of Hervé Coutau-Begarie (2010), which presents a typology similar to Eric Grove (1990), which is also based on "perception" without classifying them among themselves, but pointing to a ranking of tasks to be accomplished by these navies. For Coutau-Begarie (2010) the navy in the world can be classified into six different levels according to their power and capabilities.

These typologies took into consideration qualitative aspects and in the case of Morris a quantitative aspect, without presenting a ranking of war navies. This research attempts exactly to establish this ranking.

As to the justification of this research, the result presented by this investigation will allow a methodology of relative classification between war navy to be made available, using measurable scientific parameters that will be available to all researchers working on the naval theme.

In summary, what is intended with this research is to establish a meth-

odology to classify the world's navy in a ranking, according to measurable parameters. In order to accomplish this goal we need to define what parameters would be compared and the type of navy being evaluated, according to their capabilities and tasks.

In this way we intend to discuss the main classifications of navies according to the perceptions of the main theorists of the Maritime Studies in the present time and then to present the ambiguities of these theoretical models. Following, the proposed methodology will be discussed and the guiding principles for the classification of naval powers. Last, the application of the proposed model in the case of the navies of the Americas will be presented, presenting a comparative classification and ranking of power between them.

Classification of Navies, a problem yet to be solved

The first model that became a reference as a comparative example of naval powers was named Model of Long Cycles of Maritime Power elaborated by George Modelski and William Thompson (1987) of the Universities of Washington and the State of Florida, respectively. Their research were published in the book Sea Power in Global Politics, 1494-1993 in 1988, edited by the University of Washington.

The model proposed by Modelski / Thompson aimed to develop a set of numerical data, spanning 500 years, from 1494 to 1993 in order to analyze how maritime power (within global reach) had been distributed, the depth of this power concentration in one or more states and how these degrees of concentration varied over this period of time. Both researchers, at no time, had the intention of ranking navies in different historical times, mas only to comparatively explain their relative powers and how these powers had the capacity to use and fight for world leadership from the sea. (Modelski and Thompson 1987).

Whereas studying the dominance of maritime power in international relations, Modelski and Thompson (1987) raised fundamental problems. They verified that the conditions of world leadership of a determined State and the causes and consequences of the relevant world wars were submitted to regularities that were repetitive, cyclical and evolutionary. These regularities, changes and world wars were defined by the authors as long cycles of foreign policy. Following, the authors identified in the research the respectively dominant naval powers from 1494 till 1993: Long Cycle I – naval dominant power, Portugal, supporting powers - Spain, England and France, from 1494 till 1516; Long Cycle II - naval dominant power Netherlands, supporting powers - England, France and Spain, from 1580 till 1608; Long Cycle III - naval

dominant power Britain, supporting powers - Netherlands, France, Spain and Russia in the period from 1688 till 1713; Long Cycle IV - naval dominant power - Great Britain, supporting powers - France, Russia, Netherlands and Spain, from 1792 till 1815, and, lastly, the Long Cycle V - Netherlands - United States of America, - United Kingdom, France, Union of Soviet Socialist Republics, Germany and Japan from 1914 till 1945.

Nowadays, US dominance persists. In each year of each cycle, a percentage of power was established for the main naval actors appointed. Just as an example, in 1509, during the Long Cycle I Portugal gathered 68% of the relative power amongst the naval powers of the period, followed by Spain with 19%, France with 8% and England with 4%. At the peack of Long Cycle II, in 1608, Netherlands gathered 51% of relative power, followed by England with 31% and Spain with 18%. During Long Cycle III - Great Britain gathered 47% in 1713, Netherlands 29% and France 25%. Once more in Long Cycle IV Great Britain gathered 44% in 1808, France 21%, Russia 18%, Spain 12% and the Netherlands 4%. In the last cycle in 1945, the US gathered 50%, followed by the United Kingdom with 35%, the USSR with 7% and France with 5%, and Japan with 2%. In 1990, the US reached the amazing amount of almost 63% of power when compared to its peers.

This model presents many conceptual and methodological weaknesses, however for the scope of this research the most outstanding one is the inability to hierarchize naval powers within a classification that considers all the naval world powers in the defined time frame. It focus on an average of three or four major powers and their relative power percentages. Despite this weakness, these studies seek to compare naval powers in different historical times, by making use of a clear, but not always comprehensive, quantitative methodology.

A second attempt to rank war navies in the current time was proposed by Michael Morris in its book *Expansion of Third World Marines* published in 1985 by St Martin´s Press, which focused on navies from the so-called Third World, and pinpointed six levels based on a mainly quantitative analysis, using as parameters the definition of "major battle ships" . For Morris, Third World navies could be ranked as: Level 1 - Regional Navies composed of over 15 major surface battle ships or submarines, detaining all categories of military equipment, including onboard aircrafts, with a strong coastal defense capability and for ocean projection capacity; Level 2- Subregional Navies or of Adjacent Projection, Navies composed of over 15 major surface battle ships or submarines, detaining all categories of military equipment, with the exception of onboard aircraft, with a strong coastal defense capability and a capacity of ocean projection limited to the exclusive economic zone. Level 3 - Area Defense Navies - with 6 to 15 major surface battle ships or submarines detaining

several categories of military equipment with strong coastal defense capability limited to the exclusive economic zone; Level 4 - Coastal Navies - from 1 to 5 major surface battle ships or submarines, detaining limited military equipment and good coastal defense capability and limited projection within the exclusive economic zone; Level 5 - Surveillance Navies - with no large ships, only patrol ships capable of launching missiles and patrolling territorial waters and finally Level 6 - Symbolic Navies - without patrol ships, only boats with no ability to control territorial waters (Morris 1988).

This ranking, although relevant due to the lack of alternative classifications, is fragile in several respects. First, how to classify "third-world navies". What does this classification of countries mean? Which countries are included in this category? A second point, what do major battle ships mean? Would a destroyer be like a tanker? Or maybe a corvette? Would they be considered major ships? And how to compare them? Would they have the same rating? What about effective combat capability? And the logistical capacity to support them would not be considered? The simplicity of the model weakens it, and perceptions of what "good coastal defense capacity" can be, vary from analyst to analyst. What is an "ocean projection capability"? Can it be measured? These are points that undermine the acceptance of the Morris model as a navy ranking. Finally, there is no relative comparison between war navies, the main issue for the development of this research.

A third proposal for the classification of navies was conceived by Hervé Coutau-Bégarie in his book *Tratado de Estratégia*, published by the Naval War School in partnership with the Board of Directors of the Historical Heritage and Documentation of the Navy, in 2010. In this proposal Coutau- Bégarie, inspired by the use of sailboats of the Modelski / Thompson model, framed the combat navies in six levels as follows: 1- 1st Level Navies - these are called Global Navies. They have all the categories of modern armaments and equipment and can carry out all the functions of deterrence and intervention anywhere in the world. Their ability to retaliate is very large. Nowadays, the only Navy that fits into this category is the US Navy; 2- Second level Navies- are also navies with global capacity, with oceanic force capable of appearing in all the oceans, being able to intervene occasionally beyond its regional environment. Coutau-Bégarie fits the British, French and Russian Navies, however of course the Chinese can already be included in this group; 3- Third Level Navies- these are regional navies, with no capacity for nuclear deterrence with strong capacity to operate in ocean theater. They could be navies without aircraft carriers, but they have abundant and good quality squadrons and submarines, and also navies with aircraft carriers supported by a respectable fleet. Coutau-Bégarie points to the existence of 6 navies in this category; 4 – Fourth Level Navies - are called sub-regional with less means than those

of 3rd Level, but can intervene on the high seas. They do not have aircraft carriers and have a limited number of surface ships or submarines. Many of these navies adopt the so-called opportunity purchases which put them on a lower level; 5- Fifth Level Navies - are the coastal navies, but with good military capability, each adapted to a type of theater and specific missions. As an example, Coutau-Bégarie indicates the Belgian navy specializing in mine warfare, as well as the Swedish and Norwegian Navies capable of efficient modern submarines. These navies have few large combat ships but are able to use speedboats armed with anti-ship missiles, a trend in the 1970s especially in what he called the Third World; 6- Sixth Level Navies - are naval police forces with no military potential. They usually have boats, patrol vessels, and mining countermeasure vessels, which can provide limited surveillance in territorial waters and the exclusive economic zone. (Coutau-Bégarie 2010)

Coutau-Bégarie (2010) points out the existence of what he called symbolic navies which have whimsy assets and can barely control its own territorial waters. Nevertheless, they play a role in representing state sovereignty in a conflicted area.

This classification, while making the effort of being more qualitative than numeric, like the one of Morris, does not identify how to classify a "good military capability". What would that mean? Also, it is not specific regarding the time frame of action. Beyond that what a "limited number" of assets mean? Two, five or ten? What is a "respectable fleet"? He does not define. What a "few large combat ships" is supposed to mean? This is not defined either. Moreover, he does not rank these navies, only mentioning a few as members of each level, without identifying a relative position.

A fourth proposed classification of navies was presented by Eric Grove in his book The Future of Sea Power of 1990, published by the U.S. Naval Institute. Grove divided the navies into 10 levels according to their importance in relation to their world power. Before introducing it, he mentioned the difficulty in conducting a classification of navies because one has to take into account the type of forces employed, the sophistication of their equipment and the ability to maintain detached forces and the amount of resources available to them. Grove (1990) intended to go further than Morris by inserting in his typology the so-called Third World Marines and other strata in order to produce a "global naval hierarchical rank".

As Level 1 the author called Major Navies with Global Force and Full Power Projection - which would be the navies capable of conducting all naval military tasks on a global scale. In that case only the American Navy would be in it; Level 2 - Major Navies with Global Force and Partial Power Projection - would be navies capable of conducting most of the naval military tasks on a global scale in a partial way. They could project power away from their territo-

ry in a limited way just like the former USSR Navy; Level 3 - Average Navies with Global Force and Power Projection - would be medium-capacity marine capable of operating aircraft carriers, amphibious units, nuclear-powered attack and ballistic submarines and adequate surface forces that could conduct a major operation outside their area of interest. In this case there were the United Kingdom and French Navy, and in the medium and long term, the navies of Japan and China could be included.

The Level 4 – Average Navies with Regional Strength and Power Projection that would be navies capable of projecting force in a theater adjacent to its strategic theater of interest. According to Grove, India, Japan, China, Italy, Netherlands, Germany, Spain, Belgium, Canada, Australia, Brazil and Argentina are part of this group; Level 5 - Adjacent Navies with Power Projection - would be a navy with some possibility of projecting force away from their coastlines. Included in this group are Portugal, Greece, Turkey, Chile, Peru, Israel, South Africa, South and North Korea, Taiwan, Pakistan, New Zealand, Iran, Iraq and Saudi Arabia. Grove pointed out that none of these navies could conduct high-level naval operations over large ocean distances; Level 6 - Offshore Territorial Defense Navies are navies capable of conducting police and defensive operations up to 200 miles from their shores. This group includes natives from Norway, Denmark, Sweden, Poland, Romania, Bulgaria, the former Yugoslavia, Algeria, Morocco, Libya, Egypt, Nigeria, Cuba, Colombia, Ecuador, Venezuela, Bangladesh, Indonesia, Malaysia, Thailand and the Philippines. They have frigate ships, large corvettes, and some submarine capability; Level 7 - Inshore Territorial Defense Navies - are capable of only defending their territorial waters using missile-armed boats, short range aviation and limited submarine capability. This group includes Albania, Angola, Bahrain, Brunei, Cameroon, Ethiopia, Finland, Gabon, Kenya, Kuwait, North Oman, Oman, Qatar, Somalia, Singapore, South Yemen, Syria and Tunisia; Level 8 - Constabulary Navies are navies that serve only with police functions, not having missiles and only small arms that could be Coast Guard. This group includes the navies of Mexico, the Dominican Republic, Uruguay, Iceland, Ireland, Burma, Sri Lanka, Ghana and Tanzania. Finally, Level 9 - Tiny Navies that have minimal defense capabilities with only a formal organization and small patrol vessels. Most poor countries have Tiny Navies. (Grove 1990).

The classification presented by Eric Grove is an advance in relation to the previous typologies, because, in addition to classifying them in a more precise and comprehensive way, it cites examples of navies that fit in its different nine qualifying levels. This is the first relative classification of navies, although it does not rank them by relative powers. This typology may serve as a reference for the proposition of a new classification.

The website https://www.globalfirepower.com annually publishes a

widely used classification to compare armed forces in the world. It is an efficient reference for those who want to access relevant information about the 110 countries listed in their ranking. The site takes into account up-to-date information on the economy, geographic features such as borders, space and population, defense budgets, among many other benchmarks. This site describes in detail the numbers of the armed forces of these countries and is able to compare relatively to two countries. Regarding the navies, the site presents a comparative ranking among these services, which although extremely useful to the researchers does not accurately point out the relative powers between these naval forces. In the ranking of 2017 is listed as the number 1 navy belonging to North Korea for possessing more number of assets than the most powerful US Navy and China. This indicator equates an aircraft carrier with a patrol vessel, which distorts the comparison altogether. The US Navy, known as the most powerful in the world, possesses 415 assets and places itself at number 3 on the scale, behind North Korea with 967 and China with 714 assets of combat. The Brazilian Navy is in the 23rd position with 110 assets behind navies that are known to be of lesser importance like the Bolivian, Colombian and Myanmar.

In the presentation of the site it is indicated that the numbers do not differentiate technological capacity, crew training and the quality of the presented assets. As a comparative reference between navies it is not satisfactory.

According to Geoffrey Till in his *Seapower Guide for the Twenty-First Century* in its second edition of 2009, the act of classifying navies is "difficult and dangerous", however there are points that can be taken into consideration for those who wish to organize and classify them according to an objective, transparent and fair criterion. (Till 2009, 99) They are as follows:

1 - **Size and Nature of the Navy** in which it is taken into consideration besides the numbers the capacity to maintain large surface ships;

2 - **Geographical Range** that would be its ability to operate away from its own coast;

3 - **Function and Capability** that would be its ocean function or not and its ability to conduct certain operations;

4 - **Technology** that would be the ability to have access to advanced technologies; and

5 . **Reputation** that would translate into its power of deterrence and the perception that other navies have of it. This feature would be associated with its combat experience.

In this way, it can be deduced that there are no classifications that effectively reflect the relative powers between the navies of the world, and it is necessary to establish quantitative and qualitative criteria for classification as close as possible to reality.

As reference sources can be mentioned: the *Jane's Fighting Ships* publications, the website https://www.globalfirepower.com, specialized magazines such as *US Naval Proceedings, Naval Review and Naval Forces*, as well as UN and governmental websites and the own navies websites, in order to have a compatible and reliable database for comparisons.

The purpose of this classification is to offer the academic, business and military world a classification that is capable of measuring, relatively, naval powers within the international and regional scenarios of defense and security. In order to do this, comprehensive sources with parameters that will be determined and balanced, based on specific weights. Some factors, however, must be defined for the establishment of any consistent methodology, which are the kind of range that will be analyzed in each war navy, according to its capabilities, interests and projection? Which parameters should be quantified, taking into account determinants that interest the naval power of each state as important factors for the measurement of relative power between naval forces? What are the specific weights for each parameter set taking them into account as measures of relative power between naval forces? How to rank the world war navy according to a scoring system from 0 to 100, according to the specific weights established, starting from the most to the least powerful?

The Methodology for Classifying Navies

The methodology used was the comparative one using economic and military indicators having as reference open and respected publications in the naval environment. The parallel was indicated in the requirements necessary to compare naval powers such as technological capacity, quantity of assets and experience of combat among some. As it is not possible to confront different requirements such as quantity of assets and natural resources, we used the system of weights in which the most important requirements would have greater weights, while the smaller ones would have lower weights. Depending on the type of parameter pointed out, the quantitative evaluation was privileged when it was possible to establish numerical values for the comparison. In other cases, such as the "maritime mentality", the qualitative evaluation was privileged because it is difficult to quantify the mentality. This evaluation occurred through discussions in the Control Group[4] according to the eleven

4 Control Group refers to a research team which competed to choose the parameters selected, the relative weights and the discussions conducting the research. It was conducted by the two authors of this article with master's students from the Postgraduate Program in Maritime Studies of the Naval War School, within the scope of Pro-Defense III Project. In addition two of the members of the Group are naval officers with recognized knowledge in the naval field and

chosen parameters and then measured by weights. The parameters chosen were evaluated in quantitative terms and when impossible that way, in qualitatively terms . Weight 1 (one) was set as minimum value and weight 4 (four) as maximum value. The eleven comparative parameters sellected and their specific weights were as follows:

1- **Number of assets** - weight 2 - quantitative and qualitative analysis. Whenever necessary and when there were references to this, an attempt was made to look beyond the number of assets, looking for the readiness[5] of ships.

2- **Types of existing assets** - weight 4 - quantitative and qualitative analysis. This weight was proposed in order to differentiate an aircraft carrier from a patrol vessel, giving greater weight to the first one than to the second. Whenever possible we sought to analyze the level of training of the asset considered as both ship and crew.

3- **Naval Personnel** - weight 1 - quantitative analysis. This low relative weight considers only naval personnel without the analysis of their training.

4- **Ratio Naval Personnel / Population** - weight 1 - quantitative analysis. This number reflects the percentage of the population involved in the naval activities.

5- **Bases and Shipyards** - weight 2 - quantitative and qualitative analysis. This parameter refers to the logistical capacity of a country to support its naval assets in repairs and maintenance.

6- **Technological level** - weight 4 - qualitative analysis. This parameter refers to the technological level of a particular country and its Navy. As this parameter is difficult to measure and dependent on several factors, its analysis will be qualitative.

7- **Nuclear Capacity** - weight 2 - qualitative analysis. This parameter refers to the ability of a country to dominate the nuclear cycle and to use that energy for the benefit of the Navy.

8- **Combat experience** - weight 1 - qualitative analysis. This parameter refers to the performance of the Navy in real combat operations.

9- **Financial Capacity** - weight 4 - quantitative and qualitative analysis. This parameter refers to the capacity of a state to maintain its ships in conditions of efficient and effective readiness, being referenced to the Gross Domestic Product (GDP).

10- **Natural Resources** - weight 1 - quantitative and qualitative analysis.

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former commanders of Navy units with many years of operation at sea.

5 The readiness refers to the ability of a naval asset to be available and ready for combat considering the training of its crew and its full material availability.

This parameter refers to a state's ability to exploit its natural resources for the sake of strengthening its naval power. It is connected to other parameters already presented.

11- **Shipbuilding capacity** - weight 3 - quantitative and qualitative analysis. This parameter reflects the ability of a state to build its own combat ships and export to other states. This parameter includes the production of own weapons, sensors and ammunition. It is connected to other parameters displayed.

From what was presented we have 25 weights distributed in 11 parameters to be measured. Each weight of each parameter should be multiplied by the level at which each parameter should be measured and multiplied, going from 0 to 4. Level 0 corresponds to "having no capacity"; 0.5 corresponds to having "minimum capacity"; 1.0 corresponds to having "small capacity"; 1,5 corresponds to having "small to good"; 2.0 corresponds to having "good capacity"; 2,5 corresponds to having "good to very good"; 3.0 corresponds to having "very good capacity"; 3.5 corresponds to having "very good to excellent capacity" and 4.0 to have "excellent capacity".

Thus, for each parameter presented will correspond a numerical value that will represent the capacity of the country in that specific item. For example, a state that has a good shipbuilding capacity (weight 3) will have as a numerical indicator for this item 3 x 2 = 6. If the Control Group considers that the shipbuilding capacity of the country is good to very good 3 x 2,5 = 7,5 points.

In this way, the maximum values of each parameter will be determined as follows: Number of Assets (2 x 4 = 8); Types of Assets (4 x 4 = 16); Naval Personal-(1 x 4 = 4); Reason Personal / Population (1 x4 = 4); Technological level (4 x 4 = 16); Bases and Shipyards (2 x 4 = 8), Nuclear Capacity (2 x 4 = 8); Combat Experience (1 x 4 = 4); Financial Capacity (4 x 4 = 16); Natural Resources (1 x 4 = 4); Naval Construction Capacity (3 x 4 = 12). It can be seen that the parameters considered most relevant were the types of means, technological level and financial capacity, all with weight 4 and the least relevant parameters were effective, personal / population ratio, combat experience and natural resources, all with weight 1. The maximum score will be set at 100 points. The minimum at 0 point. At the end the naval powers will be classified according to a decreasing classification that will go from 0 to 100 points in order from the lowest naval power to the highest naval power evaluated.

The scientific nature of the research is to identify the values pertinent to each parameter for each naval power analyzed, with quantitative and qualitative evaluations by the Control Group. It is noteworthy that the evaluations of the weights are subjective factors and susceptible to diverse interpretations,

however in the absence of a more precise evaluation in the academic universe, such methodology intends to approach the current existing reality. A Control Group was set for the weight´s appraisers, composed by naval officers, academics, journalists and specialists in the area of defense.

For each parameter depending on quantification the following numerical reference shall be used:

1- **Number of Assets**

Points	**Parameter**
0	The navy does not have assets
0,5	Hold from 1 to 5 accounted assets
1,0	Hold from 5 to 39 accounted assets
2,0	Hold from 40 to 89 accounted assets
3,0	Hold from 90 to 349 accounted assets
4,0	Hold over 350 accounted assets

A survey regarding the number of assets, considering combat ships and support means for naval forces of each analyzed country was conducted to set this parameter. The Coast Guard was not considered in the survey, only the Navy. The values accounted for were debated by the Control Group taking into consideration the current available naval assets (2016) and the average projection of each level. The weight for this parameter is 2.

2- **Types of Assets**

It took into account the capacity of each asset and its projection of power, according to its average unit power. For example, the nuclear aircraft carrier has a numbering of 15, while a corvette has a number of 3. This does not necessarily mean that the nuclear aircraft carrier is five times more powerful than the corvette, as this "factor" is difficult to measure, since it will depend on their readiness for combat, training of the crew, availability of air wing, in the end factors of difficult counting. No account was taken of the age or combat capacity of each asset, since parameter 6 (Technological Level) will evaluate the technology capacity of the available means to each Navy evaluated. What can be said a priori is that we took into account a numerical factor to define the relative value of a more powerful means of combat, in this case the value 15 and for a more modest asset such as a corvette the value 3. Thus, giv-

ing an initial a priori indication of a value perceivable by the Control Group. The weight for this parameter is 4.

What is done in this parameter is the multiplication of the numberings indicated by the number of means available in a Navy. For example, a Navy that has 1 conventional aircraft carrier, a conventional cruiser and 4 frigates will have as numbers the values 10 x 1 + 5 x 1 + 4 x 4 = 31 points. The table of types of means and points is indicated below:

TYPE OF ASSET	**ASSET VALUE**
NUCLEAR AIRCRAFT CARRIER	15
CONVENTIONAL AIRCRAFT CARRIER	10
AMPHIBIOUS ASSAULT SHIP	8
HELICOPTER CARRIER	8
NUCLEAR BALLISTIC SUBMARINE	13
NUCLEAR ATTACK SUBMARINE	9
CONVENTIONAL OCEANIC SUBMARINE	6
CONVENTIONAL COASTAL SUBMARINE	4
NUCLEAR CRUISER	7
CONVENTIONAL CRUISER	5
DESTROYER/CT	4
FRIGATE	4
CORVETTE	3
OCEANIC PATROL-SHIP	0,75
PATROL-SHIP	0,25
MINESWEEPER SHIP	1
SCANNER SHIP	0,5
LOGISTICAL SUPPORT SHIP	3
LANDING SHIP	4,5
AUXILIARY SHIPS (+ HOSPITAL, COMMAND, SAVING, TUGBOAT)	1
OTHERS (RESEARCH, SCHOOL, HYDROCEANOGRAPHIC)	0,5

For the general sum of points in this parameter, the table below describes the relationship between the partial sums of each navy surveyed and the score established from 0 to 4. From this relation, the factor to be multiplied at the end of this parameter follows:

Points	**Parameter**
0	Holds up to 5 points accounted for
0,5	Holds from 6 to 20 points accounted for
1,0	Holds from 21 to 50 points accounted for
1,5	Holds from 51 to 75 points accounted for
2,0	Holds from 76 to 150 points accounted for
2,5	Holds from 151 to 500 points accounted for
3,0	Holds from 501 to 800 points accounted for
3,5	Holds from 801 to 999 points accounted for
4,0	Holds over 1000 (thousand) points accounted for

As a practical example of this operation we have the following for the combat navy composed of 1 conventional aircraft carrier, 1 conventional cruiser and 4 frigates, totaling 31 points as previously pointed out. If this navy still has 10 patrol vessels and 2 tugboats it will have as total sum the following: 31 points of the previous result plus 10 x 0.25 and 2 x 1 that will add 4.5 points. There will be the final sum of 35.5 points that in the table above will correspond to 1 point in the overall sum. This point multiplied by the weight 4 will correspond to 4 points in the total sum.

3- **Naval Personnel**

In this parameter, the constant personnel of each Navy is accounted for without considering aspects related to training, number of assets and readiness for combat. This parameter identifies the number of individuals that compose the state's naval power. The Marine Corps is included in this force, if it is established by the Navy that its effective should be included in the final numbers. The numerical table below, with weight 1, is used.

Points	Parameter
0	Total Naval Personnel accounts for less than 1.000 (thousand) individuals
0,5	Total Naval Personnel accounts for 1.001 to 5.000 individuals
1,0	Total Naval Personnel accounts for 5.001 to 15.000 individuals
1,5	Total Naval Personnel accounts for 15.001 to 30.000 individuals
2,0	Total Naval Personnel accounts for 30.001 to 50.000 individuals
2,5	Total Naval Personnel accounts for 50.001 to 100.000 individuals
3,0	Total Naval Personnel accounts for 100.001 to 200.000 individuals
3,5	Total Naval Personnel accounts for 200.001 to 500.000 individuals
4,0	Total Naval Personnel accounts for more than 500.001 individuals

The Control Group considered that any number below 1,000 individuals was not significant. In this sense, as an example, a Navy composed of 16,000 men with a multiplier factor of 1,5. The final score would be 1,5 x weight 1 = 1,5 points.

4- **Ratio Naval Personnel/ Population**

This parameter has the purpose of verifying the existance of the maritime mentality[6] in the population of a certain State. It is assumed that if the percentage of individuals linked to naval power is high, there will be a natural acceptance with the demands of the Navy and the the people will be closer to the sea. We are aware that this parameter can be contested. However, there is no doubt that the greater the population is linked to the sea, the greater is the awareness of the people that the sea matters. The calculation will be based in the number of inhabitants divided by the naval forces of the State. There is a direct correlation with the previous parameter. It will be considered weight 1.

Points	Parameter
0	Ratio observed higher than 10.001 inhabitants per 01 (one) naval personnel
0,5	Ratio observed of 4.501 to 10.000 inhabitants per 01 (one) naval personnel
1,0	Ratio observed of 3.501 to 4.500 inhabitants per 01 (one) naval personnel

6 Navy mentality refers to the identification that a given society has in relation to the sea. It is a parameter based on the qualitative perception of the Control Group and is one of the factors widely discussed in Alfred Thayer Mahan's book The Influence of Sea Power upon History, 1660-1783, a classic on the elements of maritime power of 1890.

1,5	Ratio observed of 3.001 to 3.500 inhabitants per 01 (one) naval personnel
2,0	Ratio observed of 2.501 to 3.000 inhabitants per 01 (one) naval personnel
2,5	Ratio observed of 2.001 to 2.500 inhabitants per 01 (one) naval personnel
3,0	Ratio observed of 1.501 to 2.000 inhabitants per 01 (one) naval personnel
3,5	Ratio observed of 1.001 to 1.500 inhabitants per 01 (one) naval personnel
4,0	Ratio lower than 1.000 inhabitants per 01 (one) naval personnel

5- **Bases and Shipyards**

This parameter measures the ability of a Navy to provide logistical support for its ships through naval bases and shipyards capable of repairing them. This is a key element in measuring the logistic capacity of a Navy. The greater the number of bases and yards, the better the Navy will be to support naval forces near its shores or in remote regions. It is one of the parameters pointed out by Alfred Mahan in his formulation of the elements of maritime power. The weight of this parameter is 2.

Points	**Parameter**
0	No base or yards accounted for
1,0	Between 1 and 2 bases and/or yards accounted for
2,0	Between 3 and 6 bases and/or yards accounted for
3,0	Between 7 and 10 bases and/or yards accounted for
4,0	More than 11 bases and/or yards accounted for

6- **Technological level**

It is a qualitative empirical evaluation. However, some elements were considered for the establishment of this parameter. Consideration was given to the ability to dispose of ships with nuclear propulsion which requires a higher level of technology than the conventional ones which a priori requires lower levels. In a second point, the type of missiles that these equipments are able to carry and operate. Ranked by the sophistication of the state of the art, we began with point-defense missiles, followed by area, medium range and long range missile, and ballistic missiles. The weight of this parameter by its importance was established as 4.

Points	Parameter
0	No assets for naval power
0,5	Operates coastal ship with low embarked tech
1,0	Operates conventional propulsion asset and point-defense system
1,5	Operates conventional propulsion asset and area defense system
2,0	Operates conventional propulsion asset and medium-range cruise missile
2,5	Operates conventional propulsion asset and long-range cruise missile
3,0	Operates nuclear propulsion asset
3,5	Operates nuclear propulsion asset and cruise missile system
4,0	Operates nuclear propulsion asset and ballistic missile

7- **Nuclear Capacity**

This is an important parameter for the measurement of naval power. The navy, which has the ability to master nuclear propulsion technology and carry nuclear devices has a deterrence power that differs from the others. There may be intermediate classifications for this parameter. For example, India has the ability to dominate the atomic cycle and is developing its nuclear propulsion submarine but does not have the same full capacity as the United States of America but is in the process of acquiring capability. The weight set for this parameter is 2.

Points	Parameter
0	Does not master nuclear technology, neither for propulsion nor nuclear artifacts
2,0	Master nuclear technology but does not has nuclear propulsion.
3,0	Master nuclear technology and has nuclear propulsion, but does not have nuclear artifacts
4,0	Masters the nuclear cycle, has nuclear propulsion and nuclear artifacts

8- **Combat Experience**

It is a question of verifying whether the State has been involved in a conflict with the use of naval power in the last 70 years, post-World War II, a timeframe in which is believed that the experience can be related for future generations. The capacity of a country to take part in peace operations with naval means and the engagement in regional and extrarregional conflicts with

small, medium and large effectives were taken into account. The weight for this parameter will be 1.

Points	Parameter
0	No combat experience
1,0	Holds experience in Peace Enforcement Operations
2,0	Holds experience in Regional Wars (considering the country´s location)
3,0	Holds experience in Extrarregional Wars with medium and small effectives
4,0	Holds experience in Extrarregional Wars with major effectives

9- **Financial Capacity in relation to its Gross Domestic Product**

For this parameter, the Gross Domestic Product (GDP) factor was used, which indicates the ability of a country to generate wealth in its transactions. Although GDP itself does not indicate greater financial strength, it may indicate the ability of a state to generate resources to develop its naval power in case of need. Theoretically, the larger the GDP, the more capacity the state will have in sponsoring its Navy. The weight established for this parameter is 4. The Defense budgets were not considered since many of them consider the payment of personnel and non-related Defense activities.

Points	Parameter
0	GDP below U$ 30 billion
1,0	GDP accounted for U$ 30 billion up to U$ 200 billion
2,0	GDP accounted for U$ 200 billion up to U$ 1 Trillion
3,0	GDP accounted for U$ 1 Trillion up to U$ 3 Trillion
4,0	GDP above U$ 3 Trillion

10 - **Natural Resources considering oil production**

The daily production of petroleum was taken into account for this parameter. Oil is the key element in maintaining credible naval power. In case of conflict the ability of a state to produce oil for its own use will be paramount. The weight for this parameter is 1.

Points	Parameter
0	No proved oil reserves or production
0,5	Up to 250.000 bbl/day
1,0	Between 250.000 and 500,000 bbl/day
1,5	Between 500,000 and 1.000,000 bbl/day
2,0	Between 1.000.000 and 2.000.000 bbl/day
2,5	Between 2.000.000 and 5,000.000 bbl/day
3,0	Between 5.000,000 and 8.000.000 bbl/day
3,5	Between 8.000,000, and 10.000.000 bbl/day
4,0	More than 10.000.000 bbl/day

11- Shipbuilding Capacity

In this parameter the capacity of authoctonous shipbuilding will be considered. The ability to build vessels, oceanic combat ships and submarines will be considered. The weight for this parameter is 3.

Points	Parameter
0	Does not build relevant naval asset
1,0	Produces coastal ships and watercraft
2,0	Capacity to build Conventional Submarines and/or Surface Oceanic Ships
3,0	Capacity to build Nuclear Submarines and/or Large Surface Ships
4,0	Capacity to build Nuclear Ballistic Submarines and/or Nuclear Aircraft Carriers.

In possession of these eleven metric parameters with their specific weights we can already prepare a classification of Navies ranking them from the most powerful to the least powerful. At no time, this classification will define that a 90-point Navy is twice as superior as a 45-point one. This punctuation will only rank Navies, according to values with no relation to its power, only with its relative position regarding its geographical area in the final table.

This research purpose is to rank these navies more precisely than the ones that currently exist that only take into account the qualitative question. We attempted to use ranking numerical parameters as a factor closer to reality in terms of relative power.

When determining a ranking, we tried to correlate this listing of rel-

ative power with a qualitative typology in relation to the geographic reach of each naval power evaluated. The following table will correspond to the ranking listed below:

Level 10 - Naval Power with Global Reach and Full Power Projection.
Level 9 - Naval Power with Global Reach with partial power projection
Level 8 - Naval Power with Global Reach without power projection.
Level 7 - Regional Naval Power with full power projection in the region.
Level 6 - Regional Naval Power with partial power projection in the region
Level 5 - Regional Naval Power without power projection.
Level 4 - Local Naval Power with full power projection in its territory.
Level 3 - Local Naval Power with partial power projection in its territory.
Level 2 - Local Naval Power without power projection.
Level 1- Constable or Police Naval Power.

This evaluation is fully qualitative and is presented after the analysis conducted by the Control Group. In this way, the ranking by power of each navy in a given geographic environment can be presented from a quantitative point of view and then indicate the level at which each naval power is positioned, and this evaluation is an eminently qualitative assessment. This classification by levels was based on the one formulated by Eric Grove.

In the case of a point-tie between two evaluated navies, the tiebreaker standard was the geographic reach by levels as presented above, as level 10 is considered the highest level (Naval Power with Global Reach and Full Power Projection) and the lowest level Constable or Police Naval Power.

The case of the Americas and the application of the model

Taking as a reference the navies of the Americas, a total amount of fifteen countries have naval forces in place. The United States Navy stands out, as expected, as the most powerful on the American continent. It`s position is number one with 99 points out of 100 possible. The naval power that follows them is that of Brazil with 49.5 points. This means that there are 49.5 points that separate them, but that does not mean that the US Navy is twice as powerful as the Brazilian. The points separating the two naval powers indicate the considerable distance between the two navies. The greater the difference between scores the higher the differences between the powers compared, without correlation with absolute values.

In the comparison with the parameter "Types of Existing Assets" one has an approximation with the reality of the naval powers, when compared to each other currently. The values obtained by the US in this parameter (Type of Assets) reached 1758.8. Brazil obtained 129.8 points, that is almost fourteen times lower. This parameter already demonstrates a close valuation of reality only considering the types of means in the actuality. One can even infer without great corrections that the US Navy is fourteen times the Brazilian Navy in terms of military power. By means of this valuation the following score of the American navies is reached, considering only the types of means available: USA (1758.8 points), followed by Brazil (129.8), Canada (114), Argentina (103), Peru (97), Chile (77.8), Venezuela (67), Mexico (62), Colombia (48), Ecuador (44.3), Uruguay (18.8), Paraguay (4), Bolivia (2,5). The other naval powers of the Americas are expressionless and do not score.

The other parameters considered in the methodology indicate not only the present situation among the navies considered in terms of numbers, but also the total capacity that a given country has in developing its naval power fully in comparison with other powers, that is the potential available capacity for growth. In this case we have as first naval the US with 99 points, followed by Brazil (49.5), Canada (48.5), Mexico (45.5), Argentina (43.5), Chile (42) , Venezuela (40), Colombia (39), Peru (38.5), Ecuador (30.5), Uruguay (20), Paraguay (10) and Bolivia (9.5).

When comparing the two analyzed parameters, the "Type of Assets" and "Final Result" we have almost a coincidence of ranking, USA, Brazil, Canada, and Argentina, with Mexico being placed as potentially more capable to develop its naval power compared to Argentina, but less powerful nowadays than the latter. Then five South American countries, Peru, Chile, Venezuela, Colombia and Ecuador, appear. The case of Peru is emblematic, since in the first parameter occupies the fifth place, falling in the ranking when faced with its potential capacity to develop its naval power (ninth place) with 38.5 points. The other countries analyzed are far from these.

Classifying based on its reach, the US reaches Level 10 with a Naval Power with Global Reach and with Full Power Projection. Then follows Brazil with Level 6, Regional Naval Power with Partial Power Projection in the region. Canada is at the same level as Brazil with score 6. Argentina, Chile and Mexico are placed in Level 5 - Regional Naval Power without projection of power. At the next level the 4, Local Naval Power with full power projection in its territory y are Colombia, Ecuador, Peru and Venezuela. In Level 3, Local Naval Power with projection of partial power in its territory, Uruguay. Both Bolivia and Paraguay are placed in Level 2, Local Naval Power with partial power projection in its territory.

This classification was based on discussions conducted by the Control Group, composed of naval officers with extensive experience in offshore operations, specialists in maritime power studies and students of the Postgraduate Program in Maritime Studies. It was essentially a qualitative assessment based on the operations conducted by naval powers assessed over the last ten years.

One of the perceived points was the deterioration of the Venezuelan Navy that, in continuing the current state of budget shortages, will certainly fall into the ranks and move to Level 3, Local Naval Power with partial power projection in its territory. Two others naval powers may fall into the classification. The Brazilian one being among them that due to continuing budgetary restrictions, may fall to Level 5 and the Argentinian one who may fall to level 4 on the same level as Colombia, Peru and Ecuador.

Another perceived point is the distance between the US Navy and the other American navies. It can be predicted that in the next ten years there will be an even greater increase in the comparative scores between the US and the other countries and the gap between these naval powers and the North American will be increasing, due to the fact that the US technological-financial level is going to be more and more distant from other American countries.

Final remarks

The main purpose of this research is to establish a method as close to reality as possible to classify war navies at the present time. Eleven parameters considered relevant in the evaluation of a naval power were established and specific weights were indicated for each of these parameters according to their importance one in relation to the others. The choice of each of these parameters was the product of a wide debate with experts in the field of Security and Defense. As we can see the decisions of each of these factors and the weights were a product of consensus after extensive deliberation.

Because they are perceptions motivated by the collective experience of the Control Group formed by specialists and because it is a comparative method that travels in the field of Human Sciences it can be improved. Like any process in this field it may be subject to criticism which in no way makes its application unfeasible.

The great novelty in this process is that it lowers the uncertainties motivated by the perception of a particular specialist or scholar of a classification based only on "his experience." Thus, we sought to rank naval powers and establish more reliable parameters when classifying navies, greatly reducing

the "individual perception" of each analyst or academic in the area of Defense.

In order to maintain the reliability of the information that is based on the comprehensive sources applied in the eleven parameters, it must be continuously updated by taking into account reliable and known platforms in order to keep its relative final result unsuspected.

The annex is the presentation of the model for the case of naval powers of the Americas, as discussed, within a current regional scenario with data extracted from the beginning of 2018 from reliable sources.

Annex

	Número de meios			Tipos de Meios existentes				Efetivos Navais				Efetivos/População	Bases e Estaleiros				Nível Tecnológico			
	Qtd Meios	Nível alcançado	Parametro	Pts. Obts	Valor	Nível alcançado	Parametro	Pts. Obts	Efetivo	Nível alcançado	Parametro	Pts. Obts	Razão	Nível alcançado	Parametro	Pts. Obts	Quantidade	Nível alcançado	Parametro	Pts. Obts
EUA	390	4	2	8	1758,8	4	4	16	326346	3,5	1	3,5	547,297	4	1	4	11	4	2	8
Brasil	88	2	2	4	129,8	2	4	8	60000	2,5	1	2,5	3.450,000	1,5	1	1,5	6	2	2	4
Argentina	52	2	2	4	103	2	4	8	19884	1,5	1	1,5	2.212,834	2,5	1	2,5	5	2	2	4
Bolívia	3	0,5	2	1	2,5	0	4	0	4983	0,5	1	0	2.207,506	2,5	1	2,5	0	0	2	0
Chile	32	1	2	2	77,8	2	4	8	18307	1,5	1	1,5	720,000	4	1	4	7	2	3	6
Colômbia	26	1	2	2	48	1	4	4	32056	2	1	2	1.380,571	3,5	1	3,5	5	2	2	4
Equador	24	1	2	2	44,3	1	4	4	9127	1	1	2	1.724,554	3	1	3	1	1	2	2
Guiana	0	0	2	0	0	0	4	0	0	0	1	0	7.996,130	0	1	0	0	0	2	0
Paraguai	4	0,5	2	1	4	0	4	0	1992	0,5	1	0	3.414,659	1,5	1	1,5	0	0	2	0
Peru	35	1	2	2	97	2	4	8	21665	1,5	1	1,5	1.402,262	3,5	1	3,5	2	2	1	2
Suriname	0	0	2	0	0	0	4	0	0	0	1	0	5.392,760	0	1	0	0	0	2	0
Uruguai	14	1	2	2	18,8	0,5	4	2	4672	0,5	1	0	604,211	4	1	4	1	1	1	2
Venezuela	29	1	2	2	67	1,5	4	6	48000	2,5	1	2,5	666,667	4	1	4	4	2	2	4
Canadá	57	2	2	4	114	2	4	8	8500	1	1	1	2.647,059	2	1	2	1	2	1	2
México	44	2	2	4	62	1,5	4	6	56000	2,5	1	2,5	2.214,286	2,5	1	2,5	5	2	2	4

Annex 1

Capacidade Nuclear			Experiência de Combate			Capacidade Financeira			
Nível	Parametro	Pts. Obts	Nível	Parametro	Pts. Obts	PIB	Nível alcançado	Parametro	Pts. Obts
4	2	8	4	1	4	$17.914.000.000.000,00	4	4	16
0	2	0	1	1	1	$2.346.000.000.000,00	3	4	12
0	2	0	3	1	3	$540.200.000.000,00	2	4	8
0	2	0	0	1	0	$34.180.000.000,00	1	4	4
0	2	0	1	1	1	$25.810.000.000,00	2	4	8
0	2	0	3	1	3	$37.770.000.000,00	2	4	8
0	2	0	2	1	2	$10.050.000.000,00	1	4	4
0	2	0	0	1	0	$6.155.000.000,00	0	4	0
0	2	0	0	1	0	$30.980.000.000,00	1	4	4
0	2	0	2	1	2	$202.900.000.000,00	2	4	8
0	2	0	0	1	0	$91.880.000.000,00	0	4	0
0	2	0	1	1	1	$57.470.000.000,00	1	4	4
0	2	0	0	1	0	$51.000.000.000,00	2	4	8
0	2	0	3	1	3	$1.787.000.000.000,00	3	4	12
0	2	0	1	1	1	$1.200.000.000.000,00	3	4	12

Recursos Naturais			Construção Naval				
Produção Diária	Nível alcançado	Parametro	Pts. Obts	Nível	Parametro	Pts. Obts	Pts. Totais Obts.
8653000	3,5	1	3,5	4	3	12	99
2255000	2,5	1	2,5	2	3	6	49,5
532100	1,5	1	1,5	1	3	3	43,5
51130	1,5	1	1,5	0	3	0	9,5
6666	0,5	1	0,5	1	3	3	42
989900	1,5	1	1,5	1	3	3	39
556400	1,5	1	1,5	1	3	3	30,5
0	0	1	0	0	3	0	0
0	0	1	0	1	3	3	10
69300	0,5	1	0,5	1	3	3	38,5
17000	0,5	1	0,5	0	3	0	0,5
100	0,5	1	0,5	0	3	0	20
2500000	2,5	1	2,5	1	3	3	40
3603000	2,5	1	2,5	2	3	6	48,5
2459000	2,5	1	2,5	1	3	3	45,5

Annex 2

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ABSTRACT

Classification of navies according to their relative power has been a challenge for the academic area that works with issues in the field of Security and Defense. Qualitative ratings have been presented by renowned researchers such as Colin Gray, Hervé Coutau-Begarie and Michael Morris, however these attempts have stumbled in its simplicity and little scope. From studies based on open access sources, this paper tries to develop a comparative methodology that would not only take into account qualitative but also quantitative factors. This innovative method was used to classify the navy of the different states in a ranking of power taking into account parameters such as the number of means, shipbuilding capacity, number of bases and arsenals, naval assets and availability of resources, among others, in order to rank naval powers. This methodology aims to reduce uncertainties in the classification of navies and serve as a reference for future works in the academic area that are dedicated to the fields of Security and Defense.

KEYWORDS

Methodology; Maritime Studies; War Navies

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