

Contents

1 Change Log: 13 Jan 2025

- Changed section headers to Agent Types (e.g., Chinese Ships) for easier viewing in the editor
- Changed types of merchants. Integrated speed into the table of characteristics.

2 Simulation Model

The goal of the simulation is to gain insight in consequences of an international conflict surrounding Taiwan. More specifically, the simulation model is made to analyze the impact of the effectiveness of Chinese measures to stop an effective supply chain to Taiwan. It will allow two players to participate in the simulation to give input and analyze different scenarios based on the inputs provided.

The simulation model consists of a number of environmental factors and actors. In this section we will briefly list the different settings in the world and the high-level agents interacting with each other in varying world states. In the sections following we will dive into details of the listed elements.

2.1 World Map

The world map contains the area in which the simulation takes place. This is a simplified version based on a real subsection of the world, surrounding the area of Taiwan. The world contains several layers of information that are relevant to the interactions taking place in the simulation.

The world consists the following layers:

- Time
- Landmasses
- Zones
- Receptor Grid
- Weather Condition

2.2 Agents

The simulation has a set of different agents. First of all, each of these agents belong to a country. Each country can set different rules for their agents, and has different options to manage their resources. A country is defined as one of the following:

- China
- Taiwan

- Japan
- US

The agent structure can be defined as the following:

- Chinese Ships
- Coalition Ships
- Chinese Aircraft
- Coalition Aircraft
- Chinese Submarines
- Coalition Submarines
- Merchants

2.3 Structures

Next to agents, there are a couple of fixed structures on the map that interact with agents. Structures are bases for host agents, allowing dispatching, maintenance, and more. Other structures provide other actions, but are location bound. The structures are defined as follows:

- Bases
 - Airbase
 - Harbours
- OTH Radars
- Satellite

2.4 Managers

Managers are the class overseeing individual agents. Each subsection of agents per country has a manager. Managers ensure that individual agents work together efficiently, while accounting for practical things, such as communication delays and selecting agents suitable for required actions. The following managers exist:

- China Manager
 - China OTH Manager
 - China UAV Manager
 - China Navy Manager (Subclass of general navy-manager)
- Taiwan Manager
 - Taiwan Navy Manager (Subclass of general navy-manager)

- US Manager
 - US Navy Manager (Subclass of general navy-manager)
 - US Submarine Manager
- Japan Manager
 - Japan Navy Manager
- Merchant Manager

2.5 Attack and Defense

The attacker’s skill is given by the relevant skill based on the defender type (anti-ship skill, anti-submarine skill, or anti-aircraft skill).

The relevant statistic for the defender is given by this table, depending on what types the attacker and defender are.

Attacker	Relevant Defense Characteristic		
	Ship	Airplane	Submarine
Ship	Defense against missiles	Defense against missiles	Visibility
Airplane	Defense against missiles	Defense against missiles	Visibility
Submarine	Anti-submarine skill	N/A	Visibility

Table 1: Relevant defense metrics based on attacker and defender unit types

2.6 Ammunition

The range of each agent is determined by 1) what they’re shooting at (air/sea/submarine/merchant), 2) their skill, and 3) the most capable munition that still exists for their side. Agents always shoot the farthest range munition that they can against their target (note: merchants are a separate category and thus cannot be shot). As agents shoot, they deplete the global stockpile of weapons from farthest range to closest range. A full table of these ranges and munitions will follow.

2.7 Player Input

During certain moments in the simulation, players can adapt their approaches and strategy, affecting actions that agents take and impacting the analytics. During these interceptions, players are able to change rules of engagement, strategies, and commitment of agents.

Hunter Missions

These represent the behaviors that different platforms of hunters can engage in. Below, the columns represent the escalation level of China in a given scenario. The rows then identify what is the most aggressive mission that a Chinese platform can be assigned in a scenario using that Chinese escalation level.

Platform ID #	1 – Non-kinetic	2 – Covert	3 – Overt (no strikes on Taiwan)	4 – Overt (no strikes on Japan)	5 – Total War
1 – Ships in services CCG/MSA/PAFMM	Hunting	Observing	Observing	Observing	Inactive
2 – Submarines	Inactive	Hunting	Hunting	Hunting	Hunting
3 – Minelayers	Inactive	Hunting	Hunting	Hunting	Hunting
4 – Ships in service PLAN	Observing	Inactive	Hunting	Hunting	Hunting
5 – Armed UAVs	Observing	Observing	Hunting	Hunting	Hunting
6 – Unarmed UAVs	Observing	Observing	Observing	Observing	Observing
7 – Armed Planes	Inactive	Inactive	Hunting	Hunting	Hunting
8 – Unarmed planes	Observing	Observing	Observing	Observing	Observing
9 – Missiles	Inactive	Inactive	Hunting	Hunting	Hunting

Table 2: Chinese Platform Missions by Escalation Level

Maximum Hunter Rules of Engagement

According to the scenario’s ‘Chinese Escalation Level’, various hunter platforms will be forbidden from entering into or conducting their mission in certain ‘Forbidden Zones’. The relevant options are below (retaining their lettering from the general RoE map):

- A – All Zones
- C – Taiwan Territorial
- E – Japan Territorial
- G – Filipino Territorial

Users are responsible for ensuring that assigned missions do not exceed these parameters.

Platform ID #	1 – Non-kinetic	2 – Covert	3 – Overt (no strikes on Taiwan)	4 – Overt (no strikes on Japan)	5 – Total War
1 – CCG/MSA/PAFMM	C, E, G	C, E, G	C, E, G	E, G	
2 – Submarines	A				
3 – Minelaying	A				
4 – PLAN Surface Ships	A	A	C, E, G	E, G	
5 – Armed UAVs	C, E, G	C, E, G	C, E, G	E, G	
6 – Unarmed UAVs	C, E, G	C, E, G	C, E, G	E, G	
7 – Armed Planes	A	A	C, E, G	E, G	
8 – Unarmed planes	C, E, G	C, E, G	C, E, G	E, G	
9 – Missiles	A	A	C, E, G	E, G	

Table 3: Forbidden Zones by Hunter Platform and Escalation Level

Maximum Escort Rules of Engagement

The scenario limits the most aggressive Rules of Engagement (RoE) that can be assigned to a country's escorts in each zone. Players may choose not to use the most aggressive RoE in each zone. The escort RoE levels are as follows:

- 1) Anytime: Any hunter found in the specified zone can be attacked at any time
- 2) Retaliatory: Only attack hunters that have attacked a merchant
- 3) Unmanned: Escorts can attack UAVs in the zone, but no other type of hunter
- 4) Forbidden: Hunters in that zone may not be engaged

Zone	1 – Passive Taiwan / No U.S.	2 – Ag- gressive Taiwan / No U.S.	3 – Ag- gressive Taiwan / Light U.S.	4 – Ag- gressive Taiwan / Full U.S.	5 – Ag- gressive Taiwan / Full U.S.
[A] All zones	No rule	1	1	1	1
[B] Taiwanese Contiguous Zone	2	1	1	1	1
[C] Taiwanese Territorial Waters	1	1	1	1	1
[D] Japanese Contiguous Zone	4	1	1	1	1
[E] Japanese Territorial Waters	4	2	2	1	1
[F] Filipino Contiguous Zone	4	1	1	1	1
[G] Filipino Territorial Waters	4	2	2	1	1
[H] Outside Chinese 10 Dash, Not in B-G	2	1	1	1	1
[I] Inside Chinese 10 Dash, outside B-G	4	1	1	1	1
[L] Within median line	4	4	4	4	1

Table 4: Taiwan – Escort Rules by Coalition Escalation Level

Zone	1 – Passive Taiwan / No U.S.	2 – Ag- gressive Taiwan / No U.S.	3 – Ag- gressive Taiwan / Light U.S.	4 – Ag- gressive Taiwan / Full U.S.	5 – Ag- gressive Taiwan / Full U.S.
[A] All zones	No rule	No rule	2	1	1
[B] Taiwanese Contiguous Zone	4	4	2	1	1
[C] Taiwanese Territorial Waters	4	4	1	1	1
[D] Japanese Contiguous Zone	4	4	2	2	1
[E] Japanese Territorial Waters	4	4	2	1	1
[F] Filipino Contiguous Zone	4	4	2	2	1
[G] Filipino Territorial Waters	4	4	2	1	1
[H] Outside Chinese 10 Dash, Not in B-G	4	4	2	2	1
[I] Inside Chinese 10 Dash, outside B-G	4	4	2	2	1
[L] Within median line	4	4	4	4	1

Table 5: U.S. – Escort Rules by Coalition Escalation Level

Zone	1 – Passive Taiwan / No U.S.	2 – Ag- gressive Taiwan / No U.S.	3 – Ag- gressive Taiwan / Light U.S.	4 – Ag- gressive Taiwan / Full U.S.	5 – Ag- gressive Taiwan / Full U.S.
[A] All zones	No rule	No rule	No rule	2	1
[B] Taiwanese Contiguous Zone	4	4	4	2	1
[C] Taiwanese Territorial Waters	4	4	4	2	1
[D] Japanese Contiguous Zone	2	2	2	1	1
[E] Japanese Territorial Waters	1	1	1	1	1
[F] Filipino Contiguous Zone	4	4	4	4	4
[G] Filipino Territorial Waters	4	4	4	4	2
[H] Outside Chinese 10 Dash, Not in B-G	4	4	4	2	1
[I] Inside Chinese 10 Dash, outside B-G	4	4	4	2	1
[L] Within median line	4	4	4	4	1

Table 6: Japan – Escort Rules by Coalition Escalation Level

3 World Map

In this section we discuss the details for each of the world layers. The world combines the different agents and the provided environment to make the simulation as accurate as possible. For areas such as landmasses or defined zones, polygons are established using coordinates. The polygons are an approximation of the true extent of the area. Adding too little detail in the polygons will make the simulation less realistic, whereas adding too much detail can increase computational time. Due to the differences in agent behavior, we believe that it is beneficial to use vectorization rather than rasterization of the map. This because some actions have to be completed on a very specific low-level, while many other actions can be performed on a large scale. Using a fine rasterization would again impact computational time, whereas vectorization using polygons allows us to refine interactions where required.

The world state is shown in a plot for each time step, which can also be combined to create an animation of the simulation. The speed of the simulation can also be selected.

3.1 Time

The simulation is set up in discrete time. For this, a time window has to be selected, the *time-delta* (Δt). The time delta is how much time passes in a single simulation step. A $\Delta t = 1$ corresponds to 1 hour of real world time. Choosing a low Δt will yield more accurate results, but will require significantly more computations. Whereas a high Δt will increase simulation speed, but might affect accuracy or miss important interactions.

To strike a balance between efficiency and detail, we define a second time delta, the sub-time delta: Δt_{sub} . This time delta is used for interactions where small-step accuracy is incredibly important. For example, two high-speed agents travelling in opposite directions passing through the edge of each others detection range. Using large time steps we might neglect the probability of detection, but for these interactions we can repeat the interaction using the reduced Δt_{sub} , ensuring that we increase accuracy for cases where required, without increases computation time across the entire simulation. For this reason it is important that we select a proper sub-time delta such that $\Delta t_{\text{sub}} < \Delta t$. A list of recommended values will be provided at the end.

3.2 Landmasses

Landmasses are also established using polygons. It is the assumption that no agent that is a vessel can pass through any landmass at any time. For this reason harbours are slightly off set of the coast to prevent any issues for vessels to reach harbours. Airborne agents are assumed to be able to cross landmasses unless the rules of engagement establish different rules. Landmasses are displayed in different colours to represent countries. The landmass polygons are created using approximations of the real coastlines coordinates of the countries in the area using Google Maps data.

3.3 Zones

Zones are areas in the world for which decision can be made. There are no direct impacts from the environment for these zones, but the zones rather allow players to establish agent behaviour. Players will be able to assign agents to zones, and choose between different behavioural patterns for each zone.

The following zones are included in the simulation:

- (A) All Zones
- (B) Taiwanese Contiguous Zone
- (C) Taiwanese Territorial Waters
- (D) Japanese Contiguous Zone
- (E) Japanese Territorial Waters
- (F) Filipino Contiguous Zone
- (G) Filipino Territorial Waters
- (H) Outside Chinese 10 Dash, not in B-G

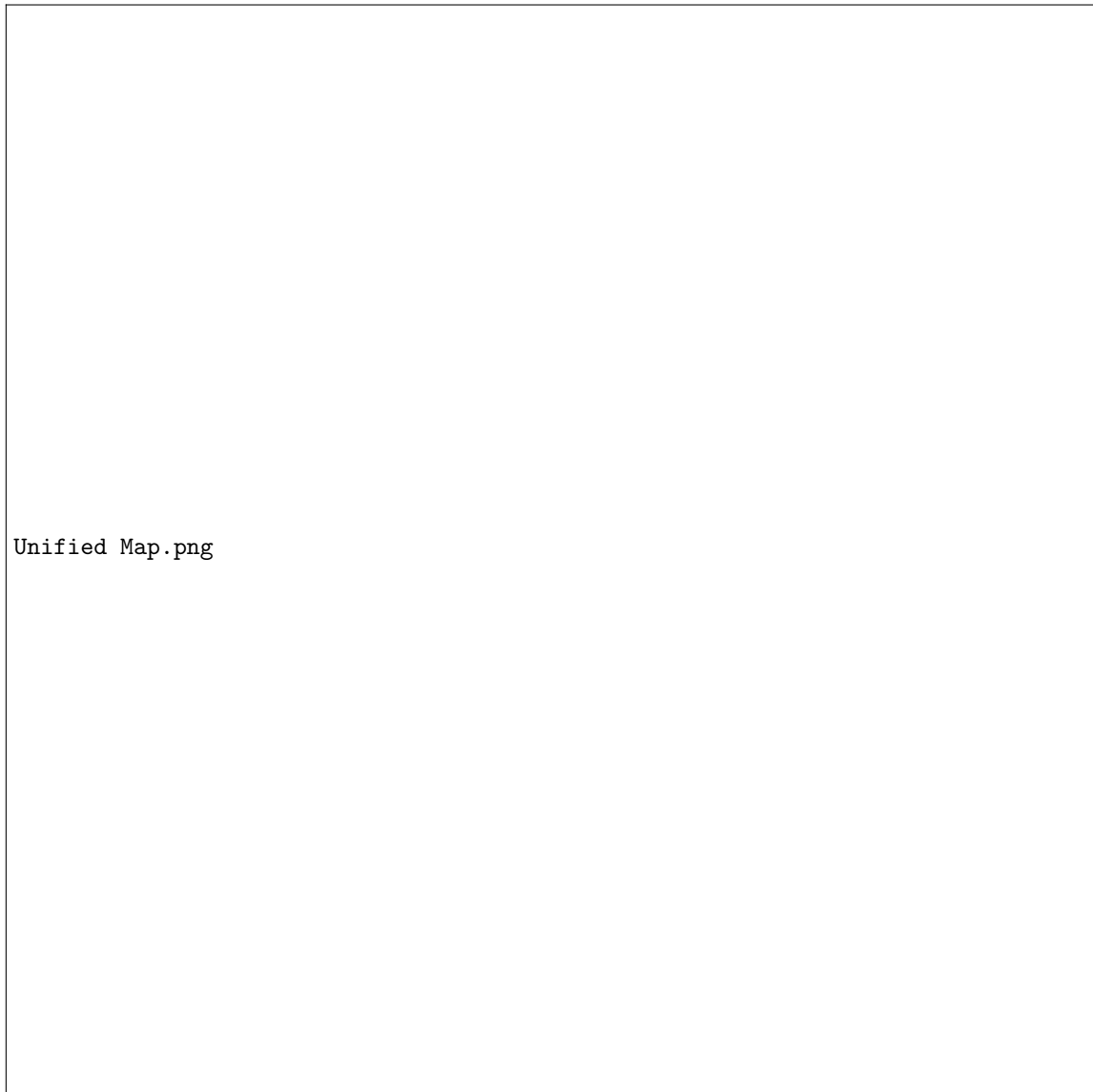


Figure 1: Zones in Simulation

- (I) Inside Chinese 10 Dash, outside B-G
- (J) Between Philippines and Taiwan
- (K) Between Japan and Taiwan
- (L) Within median line
- (M) Beyond median line [currently unused]
- (N) Holding Area
- (O) Miyako Strait [currently unused]
- (P) Primary Hunting Grounds

3.4 Receptor Grid

The receptor grid is a set of points on the world map. This grid is used to store localized data. For example, the weather in the area, or distributions of manager's beliefs on the odds of an enemy agent being located in the area. The receptors can also be displayed in the animation of the world state to gain information in manager information and underlying factors in the current world state. The receptors are merely a tool to effectively store information and assist calculations and manager decision making. Whenever information on the local world-state is required, agents (or managers) can seek the closest receptor node to represent the local state required for any calculations (e.g. probability of detection).

3.5 Weather Condition

For the current version, the weather condition is purely defined by the sea-state. For the sea state, we define sea states s , which is in a range between 0 and 7, that is $s \in \{0, 1, 2, 3, 4, 5, 6, 7\}$. The receptor grids are also used to track data on the sea state. At the start of the simulation, each sea state is equal to 2. Then each time a day passes in simulation time (i.e. $\Delta\delta = 1$), the sea state is updating using a Markov Transition Matrix. This transition matrix is estimated on historical weather data and provides a probability of transition from one sea state to another. To sample the transition probability, we create a layer of *Gaussian Perlin Noise*. This layer will allow us to have correlation in the local area, as we would expect in real life weather conditions, while sampling random values based on historical data.

4 Agents

In this section we will go into more detail on the agents interacting in (and with) the world. We will start at the highest level of the agent class, and then break down into the sub-classes. We list the attributes that each sub-class of agent is required to have, and how it is defined. Each agent has a set of *characteristics*, containing information about the agent and the agents it is interaction with, and *actions*, things the agent has to be able to do to represent its role in the simulation model.

4.1 Agent

The top level agent class covers a lot of the basic functionality that every agent needs to have. It also contains a set of actions that a significant number of agents might require, but not all agents need. These include:

- Transiting to assigned areas
- Returning to base

Agents have a number of constant properties that are defined by Matt.

- Team: 1 for China, 2 for Coalition
- Base: The starting area for an agent when spawned
- Service: The controlling agency, used for Rules of Engagement and player assignments
- Type: Ship, submarine, aircraft, or miscellaneous
- Name: Decorative for log files, not used for coding
- Number of Agents: The beginning number available to each side
- Surface Visibility: How easily the agent can be spotted by ship agents
- Air Visibility: How easily the agent can be spotted by aircraft agents
- Undersea Visibility: How easily the agent can be spotted by submarine agents
- Speed Max [km/hr]: Fastest speed possible, used when tracking or targeting
- Speed Cruise: The speed used in transiting to and from an assigned area and when observing
- Displacement: Size of a ship. Not used for aircraft or submarines.
- Endurance: How many kilometers the agent can travel with its fuel. This used to be given in hours for aircrafts, but has been changed to kilometers for simplicity.
- Helicopter: If the agent can spawn a helicopter. Currently not implemented.
- Air Detection Range: How good the agent is at detecting aircraft
- Surface Detection Range: How good the agent is at detecting ships
- Submarine Detection Range: How good the agent is at detecting submarines
- Armed: If the agent has any weapons. This is only important for failed boarding efforts; ships that attempt to board, are unsuccessful and are armed will switch to attacking with deckguns.
- Anti-ship Skill: How well the agent attacks and defends against surface ships

- Anti-ship Max Ammunition: How many times the agent can attack surface ships in one time away from its base
- Anti-air Skill: How well the agent attacks and defends against airplanes
- Anti-air Max Ammunition: How many times the agent can attack aircraft in one time away from its base
- Anti-sub Skill: How well the agent attacks and defends against submarines
- Anti-sub Max Ammunition: How many times the agent can attack submarines in one time away from its base
- Self-defending: If the agent is a modern military craft that can intercept missiles and use electromagnetic warfare [deprecated]

There are also properties that are defined within the code by Rob:

- Identifier
- Activated
- Destroyed
- Model
- Location
- Speed
- Remaining Endurance
- Distance to Travel
- Route
- Last Location
- Next Point
- Target
- Able to Attack
- Located Agent
- Convoy
- Pheromone Spread
- Pheromone Type
- Mission
- Trailing Agents

- Guarding Agents
- Support Agent
- Guarding Target
- Colour
- Current Anti-ship Ammunition: Starts equal to Max Anti-ship Ammunition, ammunition is depleted as it is used
- Current Anti-air Ammunition: Starts equal to Max Anti-air Ammunition, ammunition is depleted as it is used
- Current Anti-sub Ammunition Starts equal to Max Submarine Ammunition, ammunition is depleted as it is used
- Damaged: Integer of how much damage a merchant has taken, affects probabilities of future action taken on the merchant.
- CTL: Constructive Total Loss. If a merchant with CTL reaches its destination without being sunk, its tonnage is counted towards the turn's total, but the CTL is recorded and doesn't leave Taiwan (if that was its destination).

For each individual agent, we require basic behaviour to move around and interact with the world, as constructed in the Class Structure file. Things such as routing and maintenance can be done in the same way. However, three distinct actions differ significantly between type of agents. The following two interactions need to be mapped per agent type:

- Detecting Other Agents
- Taking Action On Other Agents

Agents have to detect other agents to take action (or get assigned to them through other sources). Each agent has a score (none/basic/advanced) for its ability to detect other agents of each given type (ship/plane/sub). Some agents have special scores in certain domains (Airborne Early Warning vs. air, T-AGOs vs. subs). Some agents have their detection scores changed by their mission (ships conducting Anti-Submarine Warfare are better detectors of submarines as they are deploying their towed arrays). For each type of agent the calculation can vary.

The second interaction is *Taking Action On Other Agents*. Once an agent has detected or is assigned to a target, agents will have to take appropriate actions. These actions also vary based on the combination of agents. We will now go over different possible interactions and list the behaviour the simulation model will follow.

5 Chinese Aircraft

For mission assignment, we distinguish between UAVs and manned aircraft.

5.1 Detecting Behaviour

5.1.1 Target: Coalition Ships or Merchants

Chinese aircraft detect coalition ships and merchants using the cube root law based on the Ship Detection Skill of the Chinese aircraft and the Airvisibility of the target.

- $P(d)$ is determined by the equation:

$$P(d) = 1 - e^{-\frac{khrs}{d^3}}$$

- e is Euler's number.
- h is the height of the searcher, which is assumed to be 10 km.
- d is the lateral distance in kilometers from the searcher to the target.
- k is as follows:
 - * Advanced: 39,633
 - * Basic: 2,747
- r is an adjustment for the radar cross section of the target:
 - * Stealthy: 0.25
 - * Vsmall: 0.5
 - * Small: 1
 - * Medium: 1.25
 - * Large: 1.5
- s is an adjustment for the sea state according to the table below:
 - * Sea State 0: 1
 - * Sea State 1: 0.89
 - * Sea State 2: 0.77
 - * Sea State 3: 0.68
 - * Sea State 4: 0.62
 - * Sea State 5: 0.53
 - * Sea State 6: 0.47

5.1.2 Target: Coalition Aircraft

Chinese aircraft detecting coalition aircraft at fixed distances based on the Air Detection Skill of the Chinese aircraft and the Airvisibility of the target.

	Large	Medium	Small	VSmall	Stealthy
AEW	648	648	496	198	59
Advanced	333	274	196	78	24
Basic	254	178	128	50	11

Table 7: How Chinese Aircraft Detect Coalition Aircraft

5.1.3 Target: Submarines

Whenever an aircraft with a player-assigned anti-submarine searching mission arrives in its assigned area, it stops and remains stationary. During that time, it creates a circle around itself defined by its Submarine Detection Skill. in which all enemy submarines are found.

The radius of the covered area by the capability of the aircraft is:

- Basic: 15.7 km
- Advanced : 27.78 km

5.2 Action Behaviour

5.2.1 Observing [Chinese Aircraft]:

- Can be used by: Any plane whose Surface Detection Range is Advanced
- When this mission begins: An aircraft the zone where it is assigned to observe
- While executing this mission: An aircraft moves inside a zone and provides information to other hunters about the locations of merchants and escort. If it detects a ship, put it in the detected merchant manager. Begin tracking that ship.
- When this mission ends:
 - 1) An aircraft detects a ship [hunter gains Tracking]
 - 2) Current endurance <20% of max endurance [hunter transits to base]

5.2.2 Tracking [Chinese Aircraft]:

- Can be used by: Any plane
- When this mission begins: 1) A Chinese aircraft with mission Observing detects a ship, or 2) a Chinese aircraft with mission 'Holding' is assigned a target
- While executing this mission: While the target is in a Rules of Engagement zone where observing is allowed and their anti-surface weapon - non-Deckgun ammunition is 0 (i.e., they are not armed), move at max speed to within 10km of the target, then match course and bearing of the target. If the hunter with Tracking is armed, then the mission should end and they should begin attacking when they deck within range of the target.
- This mission ends when:

- 1) The target ship is sunk by a different agent
[hunter resumes player-assigned mission]
- 2) The target ship goes to a zone where RoE forbids observing
[hunter resumes player-assigned mission]
- 3) The tracker with anti-surface weapon - non-Deckgun ammunition > 0 , gets within anti-ship weapon range of the target, and the target is in a zone where attacking is allowed
[hunter begins attacking]
- 4) Current endurance $< 20\%$ of max
[hunter transits to base]

5.2.3 Holding [Chinese Aircraft]:

- Can be used by: Any plane whose current anti-ship ammunition is > 0
- When this mission begins: A Chinese aircraft who the player has assigned to holding reaches the holding area
- While executing this mission: Move in a small pattern at cruising speed in a player-designated designated area (N)
- When this mission ends:
 - 1) The hunter is assigned a target merchant or escort
[hunter gains tracking mission on its target]
 - 2) An escort attacks the hunter
[hunter transits to base, report escort attack]
 - 3) Current endurance becomes $< 20\%$ of max
[hunter transits to base]

5.2.4 Attacking Ship - Non-Deckgun [Chinese Aircraft]:

- Can be used by: A plane whose Current Anti-ship Ammunition is > 0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target. Thus, a plane that is armed and assigned to tracking will move towards its target until it is within range, then move to the Attacking Ship mission when it gets within range. **Range is determined by the farthest range munition remaining for Chinese aircraft of the given skill (Basic or Advanced for Anti-Ship skill). Note: Attacks on merchants will not use the longest range Chinese missiles**
- When this mission begins: The aircraft gains AttackedAMerchant = 1. Their anti-ship ammunition goes down by one.
- While executing this mission: For every point of damage the target has, add 20% to the likelihood of the target being sunk. The chance of an undamaged merchant being sunk of a constructive total loss (CTL) is given below.

Merchant Size	1,000 – 10,000	10,001 – 20,000	20,001 – 90,000	90,001 – 120,000	120,001 + TONS
Sunk	7.7%	3.6%	2.4%	0%	0%
CTL	15.4%	21.4%	6.0%	0%	8.5%

Table 8: Damage as Percentage of Total Attacks by Size of Target Ship

The chance of an escort being sunk / CTL / damaged is given below:

Defender	None	Basic	Advanced
Attacker Basic	25 / 50 / 25	7.5 / 32.5 / 60	2.5 / 7.5 / 90
Advanced	49 / 42 / 9	14.7 / 46.6 / 38.7	4.9 / 15.1 / 80

Table 9: Comparison of Attacker and Defender outcomes.

If the target was CTL or damaged, it gets damage = damage + 1. If the target is sunk, then the attacking aircraft returns to the holding area and resumes that mission. If the target is not sunk, and if the hunter's number of anti-ship weapons is 0, then it gains mission 'Transit to base' and the targeted escort or merchant is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the aircraft has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking aircraft alters course and speed to stay within range of its target.
 2. After 10 minute Reload time, the aircraft attacks again (goes to the top of this loop).
- This mission ends when:
 - 1) The target is sunk & current anti-ship ammunition > 0
[hunter transits to holding area then resumes holding, report target sinking]
 - 2) The attacker's current anti-ship ammunition is 0
[hunter transits to base, report damage to target]
 - 3) The target enters an invalid RoE zone
[hunter transits to holding area then resumes holding]

5.2.5 Attacking Aircraft - Air-to-Air Combat [Chinese Aircraft]:

- Can be used by: A plane with Current Air-to-Air Ammunition >0, an Anti-Air Skill of "Basic" or "Advanced", and within range of a detected and RoE-valid airborne target. Thus, a plane that is armed and assigned to tracking will move toward its target until within range, then shift to the Attacking Aircraft mission. [Range is determined by the farthest-range air-to-air munition remaining, depending on the attacking aircraft's skill level.](#)

- When this mission begins: The aircraft flags TargetedAircraft = 1. Its Air-to-Air Ammunition is reduced by one.
- **While executing this mission:** The likelihood of a successful hit depends on the attacker's Anti-Air Skill and the defender's Missile Defense capability. See Table ?? below.

Table 10: Probability of Hit in Air-to-Air Combat

Attacker Anti-Air Skill	None	Basic	Advanced
Basic	50%	25%	15%
Advanced	75%	40%	25%

- Outcomes:
 - If the attack succeeds, the targeted aircraft is marked as destroyed and removed from the simulation.
 - If the attack fails, the defending aircraft continues its mission uninterrupted.
 - If the attacker still has ammunition and the target is not destroyed, the attacker may attempt to re-engage after a 10-minute reload time.
- This mission ends when:
 - 1) The target aircraft is destroyed and the attacker has remaining ammunition.
Attacker resumes holding mission or seeks next valid target.
 - 2) The attacker's Air-to-Air Ammunition reaches 0.
Attacker transits to base.
 - 3) The target enters an invalid RoE zone or is no longer detectable.
Attacker returns to holding pattern.

5.2.6 Anti-submarine Searching [Chinese Aircraft]

- Can be used by: Any aircraft with basic or advanced submarine detection
- When this mission begins: A plane whose player-assigned mission is Anti-submarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system.
- While executing this mission: The aircraft remains stationary. During that time, any submarines within its radius are detected.
- This mission ends when:
 - 1) The aircraft has been on station for 4 hours
[Aircraft mission becomes Transit to Base]
 - 2) The aircraft detects an enemy submarine and anti-submarine weapons > 0
[Aircraft mission becomes Attacking Submarine]
 - 3) The aircraft is attacked by an enemy ship or aircraft
[Aircraft mission becomes Transit to Base]

5.2.7 Attacking Submarine [Chinese Aircraft]

- Can be used by: Any aircraft with basic or advanced anti-submarine skill and whose anti-submarine ammunition > 0
- When this mission begins: A detected submarine is within the detection radius of an aircraft (5km for Basic detectors, 18.5 for advanced detectors) with the active mission of Antisubmarine Searching (no allowance for other aircraft to move in and engage a detected submarine)
- Roll on the table below about the relative anti-submarine attack capability of the aircraft and the submarine's signature. If the submarine is still within detection range of the aircraft and

Category	Large	Medium	Small	VSmall	Stealthy
Basic	40%	20%	10%	5%	2.5%
Advanced	50%	25%	12.5%	7.5%	3.25%

Table 11: How likely each Chinese aircraft anti-submarine attack is to sink a detected submarine

the aircraft's anti-submarine ammunition is > 0 , then wait another 10 minutes [Reload Time] and roll again.

- This mission ends when:
 - 1) After rolling for an attack, the aircraft's anti-submarine ammunition is 0
[Aircraft mission becomes Transit to Base]
 - 2) Submarine is destroyed, no other detected submarines are within weapons' range, and anti-submarine ammunition is > 0
[Aircraft mission becomes Antisubmarine searching]
 - 3) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the aircraft's detection range
[Aircraft mission becomes Antisubmarine searching]

5.3 Other Behaviour

Maintenance

5.4 Player Decisions

Players input missions by aircraft manning and armament to their assigned areas. Players should put in a percentage of total forces that they wish to allocate and what mission could be performed in each area.

Assigned Areas	Unarmed UAVs	Armed UAVs	Unarmed Planes	Armed Planes
[A] All zones				
[B] Taiwanese Contiguous Zone				
[C] Taiwanese Territorial Waters				
[D] Japanese Contiguous Zone				
[E] Japanese Territorial Waters				
[F] Filipino Contiguous Zone				
[G] Filipino Territorial Waters				
[H] Outside Chinese 10 Dash, not in B-G				
[I] Inside Chinese 10 Dash, outside B-G				
[J] Between Philippines and Taiwan				
[K] Between Japan and Taiwan				
[L] Within median line				
[M] Beyond median line Currently Unused				
[N] Holding Area				
Miyako Strait Currently Unused				
[P] Primary Hunting Ground				

Table 12: Assigned Areas by Properties of Chinese Aircraft

6 Coalition Aircraft

6.1 Detecting Behaviour

6.1.1 Target: Chinese Ships

Coalition aircraft detect Chinese ships using the cube root law based on the Ship Detection Skill of the Coalition aircraft and the Airvisibility of the target.

- $P(d)$ is determined by the equation:

$$P(d) = 1 - e^{\frac{-khrs}{d^3}}$$

- e is Euler's number.

- h is the height of the searcher, which is assumed to be 10 km.
- d is the lateral distance in kilometers from the searcher to the target.
- k is as follows:
 - * Advanced: 39,633
 - * Basic: 2,747
- r is an adjustment for the radar cross section of the target:
 - * Stealthy: 0.25
 - * Vsmall: 0.5
 - * Small: 1
 - * Medium: 1.25
 - * Large: 1.5
- s is an adjustment for the sea state according to the table below:
 - * Sea State 0: 1
 - * Sea State 1: 0.89
 - * Sea State 2: 0.77
 - * Sea State 3: 0.68
 - * Sea State 4: 0.62
 - * Sea State 5: 0.53
 - * Sea State 6: 0.47

6.1.2 Target: Chinese Aircraft

	Large	Medium	Small	VSmall	Stealthy
AEW	648	648	496	198	59
Advanced	333	274	196	78	24
Basic	254	178	128	50	11

Table 13: How Coalition Aircraft Detect Chinese Aircraft

6.1.3 Target: Chinese Submarines

Whenever an aircraft with a player-assigned anti-submarine searching mission arrives in its assigned area, it stops and remains stationary. During that time, it creates a circle around itself defined by its Submarine Detection Skill. in which all enemy submarines are found.

The radius of the covered area by the capability of the aircraft is:

- Basic : 15.7km
- Advanced : 18.5 km

6.2 Action Behaviour

6.2.1 Patrolling [Coalition Aircraft]:

- Can be used by: Any plane whose Surface Detection Range is Advanced
- When this mission begins: An aircraft the zone where it is assigned to observe
- While executing this mission: An aircraft moves inside a zone, searching for hunter ships.
- When this mission ends: Either 1) The agent detects a ship [aircraft begins tracking that ship] or 2) Current endurance < 20% of max endurance [Aircraft begins mission Return to Base]

6.2.2 Tracking [Coalition Aircraft]:

- Can be used by: Any plane
- When this mission begins: 1) An aircraft with mission Observing detects a ship, or 2) an aircraft with mission 'Holding' is assigned a target
- While executing this mission: While the target is in a Rules of Engagement zone where Attacking is allowed, move at max speed to within anti-ship non-deck gun range.
- This mission ends when:
 - 1) The target ship is sunk by a different agent
[Escort resumes player-assigned mission]
 - 2) The target ship goes to a zone where RoE forbids observing
[Escort resumes player-assigned mission]
 - 3) The tracker is armed, gets within anti-ship weapon range of the target, and the target is in a zone where attacking is allowed
[Aircraft begins mission Attacking Ship - Non-Deckgun]
 - 4) Current endurance < 20% of max
[Aircraft begins mission Return to Base]

6.2.3 Holding [Coalition Aircraft]:

- Can be used by: Any plane whose current anti-ship ammunition is >0
- When this mission begins: An aircraft who the player has assigned to holding reaches the holding area
- While executing this mission: Move in a small pattern at cruising speed in a player-designated designated area (N)
- When this mission ends:
 - 1) The aircraft is assigned a hunter
[Aircraft gains Tracking mission on its target]
 - 2) Current endurance becomes < 20% of max
[Aircraft begins mission Return to Base]

6.2.4 Attacking Ship - Non-Deckgun [Coalition Aircraft]:

- Can be used by: Any plane whose Current Anti-ship Ammunition is >0 .
- When this mission begins: A plane whose Current Anti-ship Ammunition is >0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target. Thus, a plane that is armed and assigned to tracking will move towards its target until it is within range, then move to the Attacking Ship mission. [Range is determined by the farthest range munition remaining for appropriate country’s aircraft of the given skill \(Basic or Advanced for Anti-Ship skill\).](#)
- While executing this mission: Their anti-ship ammunition goes down by one. For every point of damage the target has, add 20% to the likelihood of the target being sunk. The chance of a Chinese ship being sunk / CTL / damaged is given below:

Defender	None	Basic	Advanced
Attacker Basic	25 / 50 / 25	7.5 / 32.5 / 60	2.5 / 7.5 / 90
Advanced	49 / 42 / 9	14.7 / 46.6 / 38.7	4.9 / 15.1 / 80

Table 14: Coalition Aircraft vs. Chinese Ships

If the target was CTL, it gets damage = damage + 1. If the target is sunk, then the attacking aircraft returns to the holding area and resumes that mission. If the target is not sunk, and if the coalition aircraft’s number of anti-ship weapons is 0, then it gains mission ‘Transit to base’ and the targeted hunter is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the aircraft has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking aircraft alters course and speed to stay within range of its target.
 2. After 10 minute Reload time, the aircraft attacks again (goes to the top of this loop).
- This mission ends when:
 - 1) The target is sunk & current anti-ship ammunition > 0
[aircraft transits to holding area then resumes holding, report Chinese ship sinking]
 - 2) The attacker’s current anti-ship ammunition is 0
[aircraft transits to base, report damage to Chinese ship]
 - 3) The target enters an invalid RoE zone
[aircraft transits to holding area then resumes holding]

6.2.5 Attacking Aircraft - Air-to-Air Combat [Coalition Aircraft]:

- Can be used by: A plane with Current Air-to-Air Ammunition >0 , an Anti-Air Skill of “Basic” or “Advanced”, and within range of a detected and RoE-valid airborne target. Thus, a plane that is armed and assigned to tracking will move toward its target until within range, then

shift to the Attacking Aircraft mission. Range is determined by the farthest-range air-to-air munition remaining, depending on the attacking aircraft's skill level.

- When this mission begins: The aircraft flags TargetedAircraft = 1. Its Air-to-Air Ammunition is reduced by one.
- **While executing this mission:** The likelihood of a successful hit depends on the attacker's Anti-Air Skill and the defender's Missile Defense capability. See Table ?? below.

Table 15: Probability of Hit in Air-to-Air Combat

Attacker Anti-Air Skill	None	Basic	Advanced
Basic	50%	25%	15%
Advanced	75%	40%	25%

- Outcomes:
 - If the attack succeeds, the targeted aircraft is marked as destroyed and removed from the simulation.
 - If the attack fails, the defending aircraft continues its mission uninterrupted.
 - If the attacker still has ammunition and the target is not destroyed, the attacker may attempt to re-engage after a 10-minute reload time.
- This mission ends when:
 - 1) The target aircraft is destroyed and the attacker has remaining ammunition. Attacker resumes holding mission or seeks next valid target.
 - 2) The attacker's Air-to-Air Ammunition reaches 0. Attacker transits to base.
 - 3) The target enters an invalid RoE zone or is no longer detectable. Attacker returns to holding pattern.

6.2.6 Antisubmarine Searching [Coalition Aircraft]

- Can be used by: Any aircraft with basic or advanced submarine detection
- When this mission begins: A plane whose player-assigned mission is Antisubmarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system.
- While executing this mission: The aircraft remains stationary. During that time, any submarines within its radius are detected.
- This mission ends when:
 - 1) The aircraft has been on station for 4 hours
[Aircraft begins mission Return to Base]

- 2) The aircraft detects an enemy submarine and anti-submarine weapons > 1
[Aircraft mission becomes Attacking Submarine]
- 3) The aircraft is attacked by an enemy ship or aircraft
[Aircraft begins mission Return to Base]

6.2.7 Attacking Submarine [Coalition Aircraft]

- Can be used by: Any aircraft with basic or advanced submarine detection and whose anti-submarine ammunition > 0
- When this mission begins: A submarine is within the detection radius of an aircraft with the active mission of Antisubmarine Searching (no allowance for other aircraft to move in and engage a detected submarine)
- Roll on the table below about the relative capability of the ship for anti-submarine detection and the submarine's signature.

Category	Large	Medium	Small	VSmall	Stealthy
Basic	40%	20%	10%	5%	2.5%
Advanced	50%	25%	12.5%	7.5%	3.25%

Table 16: How likely each Coalition anti-submarine attack from an aircraft is to sink a detected submarine

If the submarine is still within detection range of the aircraft and the aircraft's anti-submarine ammunition is > 0 , then wait another 10 minutes [Reload Time] and roll again.

- This mission ends when:
 - 1) After rolling for an attack, the aircraft's anti-submarine ammunition is 0
[Aircraft mission becomes Transit to Base]
 - 2) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the aircraft's detection range
[Aircraft mission becomes Antisubmarine searching]

6.3 Other Behaviour

Maintenance

6.4 Player Decisions

Players input missions by aircraft manning and armament to their assigned areas. Players should put in a percentage of total forces that they wish to allocate and what mission could be performed in each area.

7 Chinese Ships

Chinese ships come from four services: CCG, MSA, PAFMM, and PLAN.

7.1 Detecting Behaviour

7.1.1 Target: Ships and Merchants

This is implemented deterministically by comparing Surface Detection Range with the Surface Visibility of the target.

Type	Large	Medium	Small	VSmall	Stealthy
Advanced	56	56	37	20	11
Basic	37	37	28	17	9

Table 17: When Ships Detect Ships by Capability, Mission, and Target Size

7.1.2 Target: Aircraft

This is implemented deterministically by comparing Aircraft Detection Range with the Surface Visibility of the target.

Target	Large	Medium	Small	VSmall	Stealthy
Advanced	463	320	239	102	30
Basic	350	244	176	70	20

Table 18: When Ships Detect Aircraft by Capability, Mission, and Target Size

7.1.3 Target: Submarines

The only advanced ships are T-AGOs ships, which are specially designed catamarans that can detect submarines at great distances. It can only detect submarines when it is executing its ASW [Anti-Submarine Warfare] mission (i.e., it does not passively detect on its way back and forth from its mission area).

Basic ships that are specifically conducting an ASW mission can deploy a towed array that is much more effective than bow mounted sonars. However, most of the time ships will not move around with this towed array as it requires the ship to move slowly and not conduct other missions. In the game, Basic ships only get that farther range if they are executing the ASW mission.

Ships without a towed array are assumed to not have a practical ASW capability and are labeled “none”.

This is currently implemented deterministically; in the future, we can change this to be a cube root with $Pd = .5$ at the specified distance.

Category	Large	Medium	Small	VSmall	Stealthy
Advanced + ASW Mission	185	74	37	18.5	9.25
Basic + ASW Mission	64.82	25.928	12.964	6.482	3.241
Basic	39.818	15.9272	7.9636	3.9818	1.9909

Table 19: When Ships Detect Submarines by Capability, Mission, and Target Size

7.2 Action Behaviour

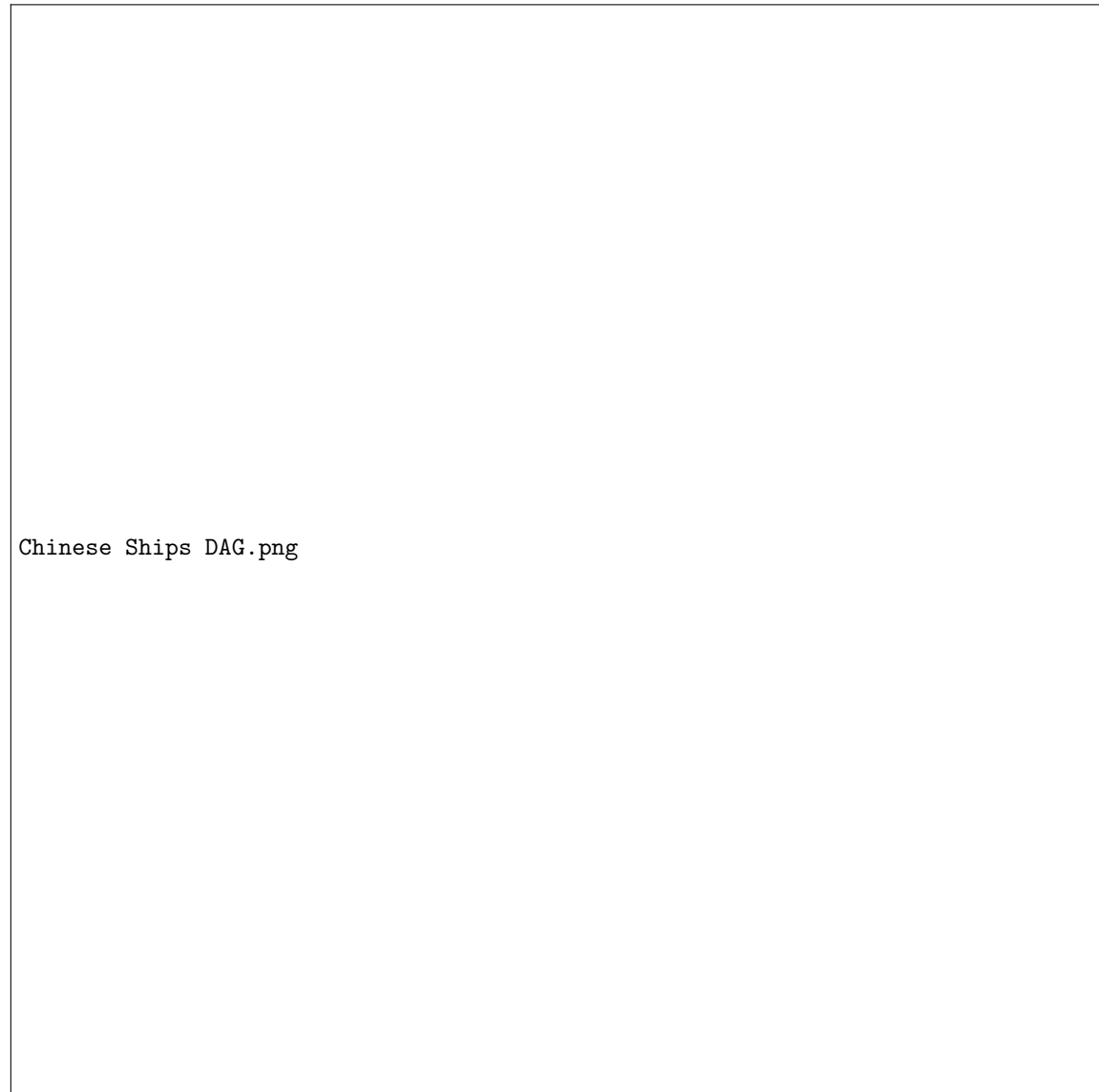


Figure 2: Chinese Ship DAG

7.2.1 Observing [Chinese Ships]:

- Can be used by: Any ship
- When this mission begins: A ship arrives at the zone where it is assigned by the player to

observe

- While executing this mission: A ship moves inside a zone and provides information to other hunters about the locations of merchants and escorts. It spreads out with other ships in that zone in accordance with the pheromones of other ships on that assigned mission and area.
- This mission ends when:
 - 1) A merchant is detected
[Hunter begins tracking that merchant; merchant is put into the detected merchant manage.]
 - 2) A coalition ship is detected and it is a valid target per RoE
[Begin 'Attacking Ship - Non-Deckgun']
 - 3) Current endurance < 20% of max
[Hunter begins 'Transit to Base']

7.2.2 Tracking [Chinese Ships]:

- Can be used by: Any ship
- When this mission begins: 1) A ship with the Observing mission detects a ship, 2) a Chinese ship with mission 'Holding' is assigned a target
- While executing this mission: While the target is in a Rules of Engagement zone where observing is allowed, move at max speed to within 10km of the target, then match course and bearing of the target.
- This mission ends when:
 - 1) The target ship is sunk by a different agent
[hunter resumes player-assigned mission]
 - 2) The target ship goes to a zone where RoE forbids observing
[hunter resumes player-assigned mission]
 - 3) China escalation is 3 or more, the tracker has a weapon in its Anti-Ship weapons list other than "Deckgun", the tracker gets within anti-ship weapon range of the target, and the target is in a zone where attacking is allowed
[hunter begins Attacking - Non-Deckgun]
 - 4) China escalation is 1, the tracker gets within 12km of the target, and the target is in a zone where boarding is allowed
[hunter begins boarding]
 - 5) Current endurance < 20% of max
[hunter transits to base]

7.2.3 Holding [Chinese Ships]:

- Can be used by: Any ship whose anti-ship max ammunition is >0
- When this mission begins: A ship who the player has assigned to holding reaches the holding area
- While executing this mission: Move in a small pattern at cruising speed in a player-designated designated area in a designated area (N)
- This mission ends when:
 - 1) The ship is assigned a target merchant or escort
[hunter gains tracking mission on its target]
 - 2) An escort attacks the ship
[Hunter returns to base, record escort chases off hunter]
 - 3) Current endurance becomes $< 20\%$ of max
[Hunter gains mission “Return to Base”]

7.2.4 Attacking Ship - Non-Deckgun [Chinese Ships]

- Can be used by: A ship whose Current Anti-ship Ammunition is >0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target. Thus, a ship that is armed and assigned to tracking will move towards its target until it is within range, then move to the Attacking Ship mission when it gets within range. **Range is determined by the farthest range munition remaining for Chinese ship of the given skill (Basic or Advanced for Anti-Ship skill). Note: Attacks on merchants will not use the longest range Chinese missiles**
- When this mission begins: The ship gains AttackedAMerchant = 1 (even if the target isn’t a merchant). Their anti-ship ammunition goes down by one.
- While executing this mission: For every point of damage the target has, add 20% to the likelihood of the target being sunk. The chance of an undamaged merchant being sunk or a constructive total loss (CTL) is given below.

Merchant Size	1,000 – 10,000	10,001 – 20,000	20,001 – 90,000	90,001 – 120,000	120,001 + TONS
Sunk	7.7%	3.6%	2.4%	0%	0%
CTL	15.4%	21.4%	6.0%	0%	8.5%

Table 20: Damage as Percentage of Total Attacks by Size of Target Ship

The chance of an escort being sunk / CTL / undamaged is given below:

Note: Unlike merchants, the righthand probability is the chance of being undamaged, not

Defender	None	Basic	Advanced
Attacker Basic	25 / 50 / 25	7.5 / 32.5 / 60	2.5 / 7.5 / 90
Advanced	49 / 42 / 9	14.7 / 46.6 / 38.7	4.9 / 15.1 / 80

Table 21: Comparison of Attacker and Defender outcomes.

damaged. Thus, a merchant is always hit, but an escort has a chance of getting no damage. If the target was CTL, it gets damage = damage + 1. If the target is sunk, then the attacking ship returns to its player given mission. If the target is not sunk, and if the hunter's number of anti-ship weapons is 0, then it gains mission 'Transit to Base' and the targeted escort or merchant is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the ship has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking aircraft alters course and speed to stay within range of its target.
 2. After 10 minute Reload time, the aircraft attacks again (goes to the top of this loop).
- This mission ends when:
 - 1) The target is sunk & current anti-ship ammunition > 0
[hunter resumes player-assigned mission, report target sinking]
 - 2) The attacker's current anti-ship ammunition is 0
[hunter transits to base, report damage to target]
 - 3) The target enters an invalid RoE zone
[hunter resumes player assigned mission]

7.2.5 Boarding Ship [Chinese Ships]:

- Can be used by: Any Chinese ship when Chinese escalation level is 1
- When this mission begins: During Chinese escalation level 1, if any detected merchant passes within 12km of a Chinese ship that is tracking that merchant
- While executing this mission:
 - 1) If the merchant is unescorted
 - 2) The Chinese ship gets LaunchedABoarder=1
 - 3) After the 'LaunchedABoarder' modifier, wait 40 minutes if the Chinese ship doesn't have a helicopter0.. Wait 10 minutes if it does have a helicopter.
 - 4) Check again to see if the merchant is unescorted and not sunk [do not recheck RoE]
 - 5) If the merchant is still unescorted, roll to see if the merchant is boarded. Probability of success starts at 22% (assuming the merchant's resistance level is Evade), with the following modifiers:
 - -20% if sea state 3. Automatic failure if sea state 4 or higher.

- +20% if the launching ship's service is CCG or MSA
 - +20% if the launching ship has a helicopter.
 - -30% if merchant's ResistanceLevel = Resist
 - +60% if merchant's ResistanceLevel = Compliant.
- 6) Upon a successful boarding, merchants get Boarded=1 and plot a course back to China. The boarding ship accompanies them. When one of them reaches China, they both disappear from the game board.
- 7) If boarding is unsuccessful:
 - If the boarding ship is armed (which is a separate variable, also determined by the ship having "Deckgun" in Anti-ship Weapon List) and the Merchant's resistance level is Resist, then the would-be boarder gains the mission "Attacking Ship with Guns"
 - Else, the boarding ship begins a transit to base mission and the next closest eligible boarder gains tracking on the merchant
- This mission ends when:
 - 1) If the merchant ever becomes escorted
[hunter returns to player assigned mission, record hunter deterred]
 - 2) If the merchant is sunk while the boarding is underway
[hunter returns to player assigned mission]
 - 3) If an armed boarder is unsuccessful against a Resist merchant
[Hunter begins mission 'Attacking Ship With Guns']
 - 4) If any other boarding mission is unsuccessful
[Hunter begins return to base mission, next closest eligible boarder gains 'tracking' mission on the merchant]
 - 5) If the boarding is successful and one of the merchant of the border makes it back to China
[despawn both, record successful seizure of merchant]

7.2.6 Attacking Ship With Guns [Chinese Ships]:

- Can be used by: An armed boarder who fails to board a merchant with Resist
- When this mission begins: Immediately after an unsuccessful boarding roll by an eligible boarder
- While executing this mission: Check RoE. Boarder matches course and speed with the merchant for 30 minutes or until the merchant reaches becomes RoE ineligible. Roll a 20% CTL, 20% sunk, 60% damaged.
- When this mission ends:
 - 1) Initial failed RoE check
[hunter resumes player assigned mission]

- 2) Failed RoE check anytime after initial failed RoE check
[hunter transits to base, record merchant damaged]
- 3) Damage roll: Merchant sunk, CTL, or damaged
[hunter transits to base, record result of merchant]

7.2.7 Anti-submarine searching [Chinese Ships]

- Can be used by: Any ship with basic or advanced submarine detection
- When this mission begins: A ship whose player-assigned mission is Anti-submarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system, or simply randomly.
- While executing this mission: The ship moves around according to pheromones. During that time, any submarines within its radius are detected. The ship's endurance decreases at its cruising rate.
- When this mission ends:
 - 1) The ships current endurance becomes less than $< 20\%$ of max
[Ship mission becomes Transit to Base]
 - 2) The ship detects an enemy submarine and anti-submarine weapons > 0
[Ship mission becomes Attacking Submarine]
 - 3) The ship is attacked by an enemy ship or aircraft
[Ship mission becomes Transit to Base]

7.2.8 Attacking submarines [Chinese Ships]

- Can be used by: Any Chinese ship with basic or advanced anti-submarine skill whose whose anti-submarine ammunition > 0
- When this mission begins: A detected submarine is within the attack range of a ship (no provision for ships to track towards a detected submarine). The ship's mission does not have to be Anti-submarine searching.
- While executing this mission: Roll on the table below about the relative anti-submarine capability of the ship (NOT detection capability) and the submarine's signature. If the

	Defender	Large	Medium	Small	Vsmall	Stealthy
Attacker	Basic	75	55	35	20	10
	Advanced	85	80	70	45	25

Table 22: Percentage Chance for an attacking ship to hit a defending submarine

submarine is still within detection range of the ship and the ship's anti-submarine ammunition is > 0 , then wait another 10 minutes [Reload Time] and roll again.

- When this mission ends:

- 1) After rolling for an attack, the ship's anti-submarine ammunition is 0 AND the ship's player-assigned mission is Submarine Searching
[Ship's mission becomes Transit to Base]
- 2) After rolling for an attack, the ship's anti-submarine ammunition is 0 and the ship's player-assigned mission is NOT Submarine Searching
[Ship resumes player-assigned mission]
- 3) Submarine is destroyed, no other detected submarines are within weapons' range, player-assigned mission is Anti-submarine searching, and anti-submarine ammunition is > 0
[Ship's mission becomes Antisubmarine searching]
- 4) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the ship's attack range
[Ship resumes player-assigned mission]

7.2.9 Attacking aircraft

: To be implemented later?

7.3 Other Behaviour

Maintenance

7.4 Player Decisions

Players input missions to Chinese ships by service to their assigned areas. Players should put in a percentage of total forces that they wish to allocate and what mission could be performed in each area.

Assigned Areas	PAFMM	CCG	MSA	PLAN
[A] All zones				
[B] Taiwanese Contiguous Zone				
[C] Taiwanese Territorial Waters				
[D] Japanese Contiguous Zone				
[E] Japanese Territorial Waters				
[F] Filipino Contiguous Zone				
[G] Filipino Territorial Waters				
[H] Outside Chinese 10 Dash, not in B-G				
[I] Inside Chinese 10 Dash, outside B-G				
[J] Between Philippines and Taiwan				
[K] Between Japan and Taiwan				
[L] Within median line				
[M] Beyond median line Currently Unused				
[N] Holding Area				
Miyako Strait Currently Unused				

Table 23: Assigned Areas by Properties of Chinese Ships

8 Coalition Ships

8.1 Detecting Behaviour

8.1.1 Target: Chinese Ships

his is implemented deterministically by comparing Surface Detection Range with the Surface Visibility of the target.

Type	Large	Medium	Small	VSmall	Stealthy
Advanced	56	56	37	20	11
Basic	37	37	28	17	9

Table 24: When Ships Detect Ships by Capability, Mission, and Target Size

8.1.2 Target: Aircraft

This is implemented deterministically by comparing Aircraft Detection Range with the Surface Visibility of the target.

Category	Large	Medium	Small	VSmall	Stealthy
Advanced	463	320	239	102	30
Basic	350	244	176	70	20

Table 25: When Ships Detect Aircraft by Capability, Mission, and Target Size

8.1.3 Target: Submarines

The only advanced ships are T-AGOs ships, which are specially designed catamarans that can detect submarines at great distances. It can only detect submarines when it is executing its ASW mission (i.e., it does not passively detect on its way back and forth from its mission area).

Basic ships that are specifically conducting an Anti-Submarine Warfare (ASW) mission can deploy a towed array that is much more effective than bow mounted sonars. However, most of the time ships will not move around with this towed array as it requires the ship to move slowly and not conduct other missions. In the game, they only get that range if they are executing the ‘Anti-submarine Searching’ mission.

Ships without a towed array are assumed to not have a practical ASW capability and are labeled “none”.

This is currently implemented deterministically by comparing the ship’s submarine detection capability and current mission status with the surface visibility of the submarine.

Category	Large	Medium	Small	VSmall	Stealthy
Advanced + ASW Mission	185	74	37	18.5	9.25
Basic + ASW Mission	64.82	25.928	12.964	6.482	3.241
Basic	39.818	15.9272	7.9636	3.9818	1.9909

Table 26: When Ships Detect Submarines by Capability, Mission, and Target Size

8.2 Action Behaviour

8.2.1 Patrolling [Coalition Ships]:

- Can be used by: Any ship

- When this mission begins: A ship arrives at the zone where it is assigned by the player to patrol
- While executing this mission: A ship moves inside a zone and engages any hunters who meet the rules of engagement. If it detects a hunter, put the hunter into the appropriate manager. If the escort has a weapon of the appropriate type (anti-ship, anti-air, or anti-sub), begin tracking that hunter.
- When this mission ends: Either 1) A hunter is detected [escort begins tracking that ship]
2) endurance < 20% of max [escort returns to base]

8.2.2 Tracking [Coalition Ships]:

- Can be used by: Any ship
- When this mission begins: 1) A ship with the Patrolling mission detects a ship, 2) an escort ship with mission 'Holding' is assigned a target
- While executing this mission: While the target is in a Rules of Engagement zone where patrolling is allowed, follow or circle the target around 10km distant. If the target is able to be attacked or boarded by the tracker, then change to that mission.
- This mission ends when:
 - 1) The target ship is sunk by a different agent
[escort resumes player-assigned mission]
 - 2) The target ship goes to a zone where RoE forbids patrolling
[escort resumes player-assigned mission]
 - 3) The tracker has a weapon in its Anti-Ship weapons list other than "Deckgun", the tracker gets within anti-ship weapon range of the target, and the target is in a zone where attacking is allowed
[escort begins Attacking - Non-Deckgun]
 - 4) The tracker gets within 12km of a boarded merchant, and the boarded merchant is not in zone L [within median line]
[escort begins liberation boarding]
 - 5) Current endurance < 20% of max
[escort transits to base]

8.2.3 Holding [Coalition Ships]:

- Can be used by: Any ship whose anti-ship max ammunition is >0
- When this mission begins: A ship who the player has assigned to holding reaches the holding area
- While executing this mission: Move in a small pattern at cruising speed in a player-designated designated area
- When this mission ends: Either 1) the ship is assigned a target [escort gains tracking mission on its target], or 2) current endurance becomes < 20% of max [escort returns to base]

8.2.4 Attacking Ship - Non-Deckgun: [Coalition Ships]

- Can be used by: A ship whose Current Anti-ship Ammunition is >0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target. Thus, a ship that is armed and assigned to tracking will move towards its target until it is within range, then move to the Attacking Ship mission when it gets within range. [Range is determined by the farthest range munition remaining for Coalition ship of the given skill \(Basic or Advanced for Anti-Ship skill\).](#)
- When this mission begins: Their anti-ship ammunition goes down by one.
- While executing this mission: For every point of damage the target has, add 20% to the likelihood of the target being sunk. The chance of a hunter being sunk / CTL / undamaged is given below:

Defender	None	Basic	Advanced
Attacker Basic	25 / 50 / 25	7.5 / 32.5 / 60	2.5 / 7.5 / 90
Advanced	49 / 42 / 9	14.7 / 46.6 / 38.7	4.9 / 15.1 / 80

Table 27: Comparison of Attacker and Defender outcomes.

If the target was CTL, it gets damage = damage + 1. If the target is sunk, then the attacking ship returns to its player given mission. If the target is not sunk, and if the coalition ship’s number of anti-ship weapons is 0, then it gains mission ‘Transit to base’ and the targeted hunter is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the ship has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking aircraft alters course and speed to stay within range of its target.
 2. After 10 minute Reload time, the aircraft attacks again (goes to the top of this loop).
- This mission ends when:
 - 1) The target is sunk & current anti-ship ammunition > 0
[hunter resumes player-assigned mission, report target sinking]
 - 2) The attacker’s current anti-ship ammunition is 0
[hunter transits to base, report damage to target]
 - 3) The target enters an invalid RoE zone
[hunter resumes player assigned mission]

8.2.5 Boarding Ship [Coalition Ships]:

- Can be used by: Any coalition ship
- When this mission begins: When a coalition ship reaches within 12km of a boarded merchant that is not inside the Chinese median line.

- While executing this mission: The boarded merchant becomes liberated. We will make this stochastic later. The escort and the merchant head to Taiwan, then the escort heads to base. The escorting hunter returns to base.
- This mission ends when:

8.2.6 Anti-submarine searching [Coalition Ships]

- Can be used by: Any ship with basic or advanced submarine detection
- When this mission begins: A ship whose player-assigned mission is Anti-submarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system, or simply randomly.
- While executing this mission: The ship moves around according to the pheromone system. During that time, any submarines within its radius are detected. The ship's endurance decreases at its cruising rate.
- When this mission ends:
 - 1) The ships current endurance becomes less than $< 20\%$ of max
[Ship mission becomes Transit to Base]
 - 2) The ship detects an enemy submarine and anti-submarine weapons > 0
[Ship mission becomes Attacking Submarine]
 - 3) The ship is attacked by an enemy ship or aircraft
[Aircraft mission becomes Transit to Base]

8.2.7 Attacking submarines [Coalition Ships]

- Can be used by: Any Coalition ship with basic or advanced anti-submarine skill whose whose anti-submarine ammunition > 0
- When this mission begins: A detected submarine is within the attack range of a ship (no provision for ships to track towards a detected submarine). The ship's mission does not have to be Anti-submarine searching.
- While executing this mission: Roll on the table below about the relative anti-submarine capability of the ship (NOT detection capability) and the submarine's signature. If the

	Defender	Large	Medium	Small	Vsmall	Stealthy
Attacker	Basic	75	55	35	20	10
	Advanced	85	80	70	45	25

Table 28: Percentage chance for an attacking ship to hit a defending submarine

submarine is still within detection range of the ship and the ship's anti-submarine ammunition is > 0 , then wait another 10 minutes [Reload Time] and roll again.

- When this mission ends:

- 1) After rolling for an attack, the ship's anti-submarine ammunition is 0 AND the ship's player-assigned mission is Submarine Searching
[Ship's mission becomes Transit to Base]
- 2) After rolling for an attack, the ship's anti-submarine ammunition is 0 and the ship's player-assigned mission is NOT Submarine Searching
[Ship resumes player-assigned mission]
- 3) Submarine is destroyed, no other detected submarines are within weapons' range, player-assigned mission is Anti-submarine searching, and anti-submarine ammunition is > 0
[Ship's mission becomes Antisubmarine searching]
- 4) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the ship's attack range
[Ship resumes player-assigned mission]

8.2.8 Attacking Ship With Guns: NOT IMPLEMENTED

- Can be used by:
- When this mission begins:
- While executing this mission:
- When this mission ends:

8.2.9 Attacking aircraft: NOT IMPLEMENTED

- Can be used by:
- When this mission begins:
- While executing this mission:
- When this mission ends:

8.3 Other Behaviour

Maintenance

8.4 Player Decisions

Players input missions by service to their assigned areas. Players should put in a percentage of total forces that they wish to allocate and what mission could be performed in each area.

Assigned Areas	ROCN	CGA	USN	USCG	JMSDF	JCG
[A] All zones						
[B] Taiwanese Contiguous Zone						
[C] Taiwanese Territorial Waters						
[D] Japanese Contiguous Zone						
[E] Japanese Territorial Waters						
[F] Filipino Contiguous Zone						
[G] Filipino Territorial Waters						
[H] Outside Chinese 10 Dash, not in B-G						
[I] Inside Chinese 10 Dash, outside B-G						
[J] Between Philippines and Taiwan						
[K] Between Japan and Taiwan						
[L] Within median line						
[M] Beyond median line Currently Unused						
[N] Holding Area						
Miyako Strait Currently Unused						

Table 29: Assigned Areas by Coalition Ship Service

9 Chinese Submarines

9.1 Detecting Behaviour

9.1.1 Target: Ships and Merchants

	Large	Medium	Small	VSmall	Stealthy
Advanced	90	90	45	9	0
Basic	45	9	9	0	0

Table 30: Classification by Size and Stealth Level

9.1.2 Target: Aircraft

Submarines are not capable of detecting aircraft.

9.1.3 Target: Submarines

This is implemented deterministically by comparing the ship's submarine detection capability (Basic or Advanced) and current mission status (Anti-submarine Searching vs. not) with the submarine visibility of the submarine.

	Large	Medium	Small	VSmall	Stealthy
Advanced + ASW Mission	37.00	14.80	7.40	3.70	1.85
Advanced	27.78	11.112	5.556	2.778	1.389
Basic	18.52	7.408	3.704	1.852	0.926

Table 31: Detection Radii for Chinese Submarines vs. Coalition Submarines

9.2 Action Behaviour

9.2.1 Observing [Chinese Subs]:

- Can be used by: Any sub
- When this mission begins: A submarine enters the the zone where it is assigned to observe
- While executing this mission: A submarine moves inside a zone according to pheromones. If you detect a ship or submarine, begin tracking that ship.
- When this mission ends:
 - 1) The agent detects a ship or submarine [hunter begins tracking that ship or submarine]
 - 2) Current endurance <20% of max endurance [hunter transits to base]
 - 3) Submarine is attacked [hunter transits to base]

9.2.2 Tracking [Chinese Subs]:

- Can be used by: Any sub with Observing mission
- When this mission begins: 1) A Chinese sub with mission Observation detects a ship, or 2) a Chinese sub with mission 'Holding' is assigned a target
- While executing this mission: While the target is in a Rules of Engagement zone where observing is allowed, move on an intercept point towards the target.
- This mission ends when:
 - 1) The target ship or sub is sunk by a different agent
[hunter resumes player-assigned mission]

- 2) The target ship or sub goes to a zone where RoE forbids observing
[hunter resumes player-assigned mission]
- 3) Any submarine who has > 0 attacks in its ammunition, gets within 11km of any detected ship, and the ship is in a zone where attacking is allowed
[hunter begins Attacking Ship - Non-Deckgun [Chinese Subs]]
- 4) Any submarine who has > 0 attacks in its ammunition, gets within 11km of any detected sub, and the sub is in a zone where attacking is allowed
[hunter begins Attacking Submarine [Chinese Subs]]
- 5) Current endurance $< 20\%$ of max
[hunter returns to base]

9.2.3 Attacking Ship - Non-Deckgun [Chinese Subs]:

- Can be used by: A submarine whose Current Anti-ship Ammunition is > 0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target.
- When this mission begins: The submarine gains AttackedAMerchant = 1. Their anti-ship ammunition goes down by one.
- While executing this mission: The chance of target being HIT is given below:
If a hit is scored, then roll on the table below for whether the target is sunk based on the

Defender	None	Basic	Advanced
Attacker Basic	50%	25%	10%
Attacker Advanced	70%	50%	20%

Table 32: Chance of One Chinese Anti-Ship Attack HITTING a Targeted Ship

damage (this can be shared with damage from other sources). Any escort that is hit becomes sunk. If the target was hit but not sunk, it gets damage = damage + 1. If the target is sunk,

TANKER or LNG Carrier	Probability of Sinking
1st hit	75%
2 hits	100%
3 hits	100%
OTHER	Prob of Sink
1st hit	53%
2 hits	73%
3 hits	71%
4 hits	100%

Table 33: Probability of sinking based on damage for different ship types

then the attacking submarine resumes its player-assigned mission. If the target is not sunk,

and if the hunter's number of anti-ship weapons is 0, then it gains mission 'Transit to base' and the targeted escort or merchant is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the submarine has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking submarine alters course and speed to stay within range of its target.
 2. After 45 minute Reload time, the submarine attacks again (goes to the top of this loop).
- This mission ends when:
 - 1) The target is sunk & current ammunition > 0
[hunter resumes player assigned-mission, report target sinking]
 - 2) The attacker's current ammunition is 0
[hunter transits to base, report damage to target]
 - 3) The target enters an invalid RoE zone
[hunter transits to holding area then resumes holding]

9.2.4 Anti-submarine searching [Chinese Subs]

- Can be used by: Any sub with basic or advanced submarine detection
- When this mission begins: A sub whose player-assigned mission is Anti-submarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system, or simply randomly.
- While executing this mission: The sub searches according to pheromones. During that time, any submarines within its radius are detected. The sub's endurance decreases at its cruising rate.
- When this mission ends:
 - 1) The sub's current endurance becomes less than $< 20\%$ of max
[Sub mission becomes Transit to Base]
 - 2) The sub detects an enemy submarine and ammunition > 0
[Sub mission becomes Attacking Submarine]
 - 3) The sub is attacked by an enemy ship or aircraft
[Sub mission becomes Transit to Base]

9.2.5 Attacking submarines [Chinese Submarines]

- Can be used by: Any Chinese ship with basic or advanced anti-submarine skill whose ammunition > 0 who is within 11km of a detected enemy submarine that is within an appropriate RoE zone
- When this mission begins: A detected submarine is within the attack range of a sub (no provision for ships to track towards a detected submarine). The sub's mission does not have to be Anti-submarine Searching.

- While executing this mission: Roll on the table below about the relative anti-submarine capability of the sub and the defending submarine's signature. If the submarine is still within

Defender	Large	Medium	Small	Vsmall	Stealthy
Attacker Basic	55	40	25	10	5
Attacker Advanced	95	55	35	15	5

Table 34: Attack success rates for Chinese Subs vs. Coalition Subs

detection range of the ship and the ship's anti-submarine ammunition is > 0 , then wait another 45 minutes [Reload Time] and roll again.

- When this mission ends:
 - 1) After rolling for an attack, the sub's ammunition is 0 AND the sub's player-assigned mission is Submarine Searching
[Sub's mission becomes Transit to Base]
 - 2) After rolling for an attack, the sub's anti-submarine ammunition is 0 and the sub's player-assigned mission is NOT Submarine Searching
[Ship resumes player-assigned mission]
 - 3) Submarine is destroyed, no other detected submarines are within weapons' range, player-assigned mission is Anti-submarine searching, and anti-submarine ammunition is > 0
[Sub's mission becomes Antisubmarine searching]
 - 4) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the sub's attack range
[Ship resumes player-assigned mission]

9.3 Other Behaviour

Maintenance

9.4 Player Decisions

Normal allocation to locations

10 Coalition Submarines

10.1 Detecting Behaviour

10.1.1 Target: Ships

10.1.2 Target: Aircraft

Submarines are not capable of detecting aircraft.

	Large	Medium	Small	VSmall	Stealthy
Advanced	90	90	45	9	0
Basic	45	9	9	0	0

Table 35: Classification by Size and Stealth Level

10.1.3 Target: Submarines

This is implemented deterministically by comparing the ship's submarine detection capability (Basic or Advanced) and current mission status (Anti-submarine Searching vs. not) with the submarine visibility of the submarine.

	Large	Medium	Small	VSmall	Stealthy
Advanced + ASW Mission	37.00	14.80	7.40	3.70	1.85
Advanced	27.78	11.112	5.556	2.778	1.389
Basic	18.52	7.408	3.704	1.852	0.926

Table 36: Detection Radii for Coalition Submarines vs. Chinese Submarines

10.2 Action Behaviour

10.2.1 Patrolling [Coalition Sub]:

- Can be used by: Any Sub
- When this mission begins: A sub arrives at the zone where it is assigned by the player to patrol
- While executing this mission: A sub moves inside a zone according to pheromones and engages any hunters who meet the rules of engagement. If it detects a hunter, put the hunter into the appropriate manager. If the escort has a weapon of the appropriate type (anti-ship, anti-air, or anti-sub), begin tracking that hunter.
- When this mission ends: Either 1) A hunter is detected [escort begins tracking that ship]
2)endurance < 20% of max [escort returns to base]

10.2.2 Tracking [Coalition Subs]:

- Can be used by: Any sub
- When this mission begins: A coalition sub detects a ship
- While executing this mission: While the target is in a Rules of Engagement zone where observing is allowed, move on an intercept point towards the target.
- This mission ends when:

- 1) The target is sunk by a different agent
[escort resumes player-assigned mission]
- 2) The target goes to a zone where RoE forbids observing
[escort resumes player-assigned mission]
- 3) Any submarine who has > 0 ammunition, gets within 11km of any detected ship, and the target is in a zone where attacking is allowed
[escort begins Attacking Ship - Non-Deckgun]
- 4) Any submarine who has > 0 ammunition, gets within 11km of any detected sub, and the target is in a zone where attacking is allowed
[escort begins Attacking Submarine]
- 5) Current endurance $< 20\%$ of max
[escort returns to base]

10.2.3 Attacking Ship - Non-Deckgun [Coalition Subs]:

- Can be used by: A submarine whose Current Ammunition is > 0 , has Anti-ship Skill == “Basic” OR “Advanced”), and is within range of a detected, RoE valid target.
- When this mission begins: Their anti-ship ammunition goes down by one.
- While executing this mission:
The chance of target being HIT is given below:

Defender	None	Basic	Advanced
Attacker Basic	50%	25%	10%
Attacker Advanced	70%	50%	20%

Table 37: Chance of One Coalition Submarine Anti-Ship Attack HITTING a Targeted Ship

If a hit is scored, then roll on the table below for whether the target is sunk based on the damage (this can be shared with damage from other sources).

If the target was hit but not sunk, it gets damage = damage + 1. If the target is sunk, then the attacking submarine resumes its player-assigned mission. If the target is not sunk, and if the hunter’s number of anti-ship weapons is 0, then it gains mission ‘Transit to base’ and the targeted Chinese ship is put back into the appropriate manager. If ammunition remains and the target is not sunk, then:

1. While the submarine has anti-ship ammunition greater than 0, the target still meets RoE, and the target is not sunk, an attacking submarine alters course and speed to stay within range of its target.
2. After 45 minute Reload time, the submarine attacks again (goes to the top of this loop).

- This mission ends when:
 - 1) The target is sunk & current ammunition > 0
[escort resumes player assigned-mission, report target sinking]
 - 2) The attacker's current ammunition is 0
[escort transits to base, report damage to target]
 - 3) The target enters an invalid RoE zone
[escort transits to holding area then resumes holding]

10.2.4 Anti-submarine searching [Coalition Submarine]

- Can be used by: Any sub with basic or advanced submarine detection
- When this mission begins: A sub whose player-assigned mission is Anti-submarine Warfare arrives in its assigned area. There should be some procedure for deciding where in an assigned area each particular plane searches; possibly using the pheromone system, or simply randomly.
- While executing this mission: The sub searches according to pheromones. During that time, any submarines within its radius are detected. The sub's endurance decreases at its cruising rate.
- When this mission ends:
 - 1) The sub's current endurance becomes less than $< 20\%$ of max
[Sub mission becomes Transit to Base]
 - 2) The sub detects an enemy submarine and ammunition > 0
[Sub mission becomes Attacking Submarine]
 - 3) The sub is attacked by an enemy ship or aircraft
[Sub mission becomes Transit to Base]

10.2.5 Attacking submarines [Coalition Submarines]

- Can be used by: Any coalition ship with basic or advanced anti-submarine skill whose ammunition > 0 and who is within 11km of a detected enemy submarine that is within an appropriate RoE zone
- When this mission begins: A detected submarine is within the attack range of a sub (no provision for ships to track towards a detected submarine). The sub's mission does not have to be Anti-submarine Searching.
- While executing this mission: Roll on the table below about the relative anti-submarine capability of the sub and the defending submarine's signature.

If the submarine is still within detection range of the ship and the ship's anti-submarine ammunition is > 0 , then wait another 45 minutes [Reload Time] and roll again.
- When this mission ends:

Defender	Large	Medium	Small	Vsmall	Stealthy
Attacker Basic	55	40	25	10	5
Attacker Advanced	95	55	35	15	5

Table 38: Attack success rates for Coalition Subs vs. Chinese Subs

- 1) After rolling for an attack, the sub's ammunition is 0 AND the sub's player-assigned mission is Submarine Searching
[Sub's mission becomes Transit to Base]
- 2) After rolling for an attack, the sub's anti-submarine ammunition is 0 and the sub's player-assigned mission is NOT Submarine Searching
[Ship resumes player-assigned mission]
- 3) Submarine is destroyed, no other detected submarines are within weapons' range, player-assigned mission is Anti-submarine searching, and anti-submarine ammunition is > 0
[Sub's mission becomes Antisubmarine searching]
- 4) Upon unsuccessfully rolling for destruction of the submarine, the submarine is no longer in the sub's attack range
[Ship resumes player-assigned mission]

10.3 Other Behaviour

Maintenance

10.4 Player Decisions

Normal location and mission allocation decisions

11 Merchants

Each week, the players input what types of merchants appear and how they head towards Taiwan.

11.1 Merchant Characteristics

Merchants are of type Tankers, Bulk Carriers, Containers, LNG, General Cargo, Ro-Ros, or Reefers. There are different sizes of each type of merchant. Each turn, players will have to specify how many merchants of each size and type appear on the eastern edge of the map.

Type	Class	Code	DWT (1,000s)	Cargo Size (1,000s)	Cargo Value (1,000s)	Speed (km/h)	Visibility
Tanker	VLCC	T1	320	304	160	29.6	Large
	Suezmax	T2	157	147	80	29.6	Medium
	Aframax	T3	115	105	60	29.6	Medium
	Panamax	T4	75	67.5	40	29.6	Medium
	MR	T5	51	45	28	27.8	Medium
	Handy	T6	37	33	25	27.8	Medium
	Small	T7	6	5	6	27.8	Small
Bulk Carriers	Capesize	B1	180	180	23.4	26.9	Large
	Panamax	B2	75	82	10.7	25.9	Medium
	Handymax	B3	62	62	8.1	25.0	Medium
	Handysize	B4	38	38	4.9	24.1	Medium
Container Ships	≥ 12k+ TEU	C1	150	196	560	44.4	Large
	8-12k TEU	C2	120	140	480	44.4	Large
	3-8k TEU	C3	80	90	400	42.6	Medium
	2-3k TEU	C4	30	35	100	38.9	Medium
	900-2k TEU	C5	20	20	80	38.9	Medium
	≤ 900 TEU	C6	8	7	40	38.9	Small
LNG	LNG	LNG	87	174	48.1	38.9	Large
General Cargo	General Cargo	GC1	50	45	12	27.8	Medium
	General Cargo	GC2	12.5	11.3	3	27.8	Small
	General Cargo	GC3	2	1.8	0.5	27.8	Small
Ro-Ro		RoRo	8.5	10	6	40.7	Small
Reefer		Reef	7.5	6.75	25	40.7	Medium
LPG	VLGC	LPG1	55	84	35	37.0	Medium
	Medium	LPG2	25	32.5	20	35.0	Medium
	Coaster	LPG3	4	4	5	32.0	Small
Chemical	Oceangoing	Chem1	50	45	22	36.0	Medium
	Medium	Chem2	22.2	20	10	34.0	Medium
	Coastal	Chem3	4.3	4	2	30.0	Small

Table 39: Merchant Characteristics

When they spawn, they are randomly assigned to a destination as follows:

1. 40% chance for Kaoshiung
2. 30% chance for Taichung
3. 25% chance for Keelung
4. 5% chance for Hualien

They have a variable for how easy it is for a hunter to board them. Users assign what percentage of each merchant has the behaviors for each week. Users are shown the following guidelines:

- Compliant: When a Chinese ship approaches within 15km, the merchant stops and waits to be boarded.
- Evacative: A merchant continues to Taiwan if approached by a Chinese ship, but does not resist boarding.
- Resistant: A merchant continues to Taiwan and any attempt by Chinese ships to board is given a negative modifier.

11.2 Behavior

Scenario	1 – Passive Taiwan / No U.S.	2 – Aggressive Taiwan / No U.S.	3 – Aggressive Taiwan / Light U.S.	4 – Aggressive Taiwan / Full U.S.	5 – Aggressive Taiwan / Full U.S.
Market	Compliant	Compliant	Compliant	Compliant	Compliant
Taiwan	Evade	Resist	Resist	Resist	Resist
U.S.	Compliant	Compliant	Evade	Resist	Resist
Japan	Compliant	Compliant	Compliant	Evade	Resist

Table 40: Reaction of Merchants to Boarding by Nationality Under Various Scenarios

Merchant LoS for evading is set to be 15kms.

Compliant - stops at position.

Evade - Try and continue to (Taiwan) territorial waters.

Resist - Affects modifier for boarding success chance.

11.3 Behavior

That is determined by their nationality and the scenario.

After spending three days in the harbour, the merchant will try to leave the map the way it entered.

Merchants can travel either alone or in Convoys, which is decided by the *Merchant Manager*.

Detecting Behaviour

Merchants do not detect.

Action Behaviour

- Transit to Taiwan
 - Can be used by:
 - When this mission begins:
 - While executing this mission:
 - When this mission ends:
- Transit from Taiwan
 - Can be used by:
 - When this mission begins:
 - While executing this mission:
 - When this mission ends:
- Move after boarding to China
 - Can be used by:
 - When this mission begins:
 - While executing this mission:
 - When this mission ends:

Other Behaviour

Maintenance

Player Decisions

Don't worry about convoying for now.

11.3.1 OTH

OTH detects in 700-3500 range band at an angle of 35 degrees.

Detecting Behaviour

Target: *Merchant*

Detection of Merchants depends on the size of the agents and the sea state. This follows a deterministic table. The closest available UAV will follow up on the detection.

Target: *Escorts*

Action Behaviour

Other Behaviour

Maintenance

Player Decisions

12 Proposed New Mission Structure

Mission	Player Directed	China Aircraft	Coalition Aircraft	China Ships	Coalition Ships	China Submarines	Coalition Submarines	Merchants
Observing	✓	✓		✓		✓		
Tracking		✓	✓	✓	✓	✓		
Holding	✓	✓	✓				✓	
Attack Ship - Non-Deckgun		✓	✓	✓	✓	✓	✓	
Attacking Ship - Deckgun				✓	✓			
Boarding				✓	✓			
Anti-submarine searching	✓	✓	✓	✓		✓	✓	
Attacking submarines		✓	✓	✓	✓	✓	✓	
Attacking aircraft		✓	✓	✓	✓	✓	✓	
Patrolling	✓		✓				✓	
Escorting	✓		✓		✓		✓	
Moving to Intercept						✓	✓	
Attacking with Torpedoes						✓	✓	
Undersea TEL	✓					✓		
Transit to Base		✓	✓	✓	✓	✓	✓	
Transit to China								✓
Transit to Assigned Area		✓	✓	✓	✓	✓	✓	✓

12.1 Base Missions - For China Ships DAG

- Unit Spawn
 - 1) Transit to Assigned Area
- Observing
 - 1) Tracking
 - 2) Transit to base
- Tracking
 - 1) Transit to Assigned Area
 - 2) Transit to base
 - 3) Attacking submarines
 - 4) Attacking aircraft
 - 5) Attacking Ship - Non-Deckgun
 - 6) Boarding
- Holding
 - 1) Transit to Base
 - 2) Tracking
- Attack Ship - Non-Deckgun
 - 1) Transit to Assigned Area
 - 2) Transit to base

- Attacking Ship - Deckgun
 - 1) Transit to base
- Boarding
 - 1) Transit to China
 - 2) Attacking - Deckgun
- Anti-submarine searching
 - 1) Attacking submarines
 - 2) Transit to base
- Attacking submarines
 - 1) Transit to Assigned Area
 - 2) Transit to base
- Transit to Assigned Area
 - 1) Observing
 - 2) Holding
 - 3) Anti-submarine searching
- Transit to Base
 - 1) Despawn
- Transit to China
 - 1) Despawn
 - 2) Attacking Ship - Deckgun
- Despawn

12.2 Base Missions - Detailed

- Observing
- Tracking
 - 1) The target ship is sunk by a different agent
[New Mission: Player-assigned mission]
 - 2) The target ship goes to a zone where RoE forbids observing
[New Mission: Player-assigned mission]
 - 3) Any submarine who has > 0 torpedoes in its anti-ship weapon list, gets within 7km of any detected target, and the target is in a zone where attacking is allowed
[New Mission: Attacking with Torpedoes]

4) Current endurance < 20% of max
[New Mission: Transit to base]

- Holding
- Attack Ship - Non-Deckgun
- Attacking Ship - Deckgun
- Boarding
- Anti-submarine searching
- Attacking submarines
- Attacking aircraft
- Patrolling
- Escorting
- Moving to Intercept
- Attacking with Torpedoes
- Undersea TEL
- Transit to Assigned Area
- Transit to Base
- Transit to China

12.3 Player Directed Missions

Temporary page!

L^AT_EX was unable to guess the total number of pages correctly. As there was some unprocessed data that should have been added to the final page this extra page has been added to receive it.

If you rerun the document (without altering it) this surplus page will go away, because L^AT_EX now knows how many pages to expect for this document.