CSCD 350 Project Task 2

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Part 1: Scenarios

1: Maneuvering a battleship around a stationary land mass to attack.

A battleship moving through the water and needs to turn to move around a land mass to initiate

an attack.

2: Flying a bomber aircraft over an enemy base.

An ally bomber aircraft launches from base and flies over an enemy base.

3: Using a countermeasure to deter incoming heat-seeking missiles.

Heat-seeking missiles are approaching an ally fighter aircraft. A countermeasure needs to be

used to deter them to keep the aircraft and pilot safe.

4: Dropping bombs from an aircraft onto ground forces.

Bombs are dropped from a bomber aircraft. The bombs are aimed at ground forces to do damage

to them.

5: Dropping depth charges from a battleship.

Depth charges are dropped from a battleship to attack an underwater vessel.

Part 2: User Stories

1.1: Flanking an enemy

As a captain I want to turn around the nearby land mass so that I can attack a detected enemy ship.

2.1: Bombing an enemy base

As a pilot I want to fly within the vicinity of the enemy base to drop bombs onto it to cause damage to assets.

3.1: Defense in an aerial battle.

As a pilot I want to deter incoming enemy missiles so that I can successfully defend against an aerial attack.

4.1: Counterattacking enemy forces.

As a pilot I want to bomb enemy forces from the sky to counter their attack.

5.1: Bombing an enemy submarine

As a captain I want to bomb the enemy submarine with depth charges to cause substantial damage.

1.1.1: What is the angle of the necessary turn?

The turn is a full 90-degree turn.

1.1.2: How long is the turn in question?

The turn is 1 mile in length.

2.1.1: Where will the aircraft start?

The ally aircraft will takeoff from a landing platform within the ally base.

2.1.2: Where is the enemy base?

The enemy base is 50 miles from the starting location.

3.1.1: How will the countermeasure deter the missiles?

The countermeasure will use an infrared generator to confuse the signals picked up by the

missiles.

3.1.2: Where is the countermeasure located?

The countermeasure is located on the underbelly of the aircraft.

4.1.1: What bombs will be used?

Smart bombs will be used to allow for a precise counterattack.

4.1.2: How will the bombs be launched?

The bombs will be manually launched by the pilot of the bomber aircraft when the targets are in

range.

5.1.1: Where is the submarine?

The enemy submarine is 150m below sea level.

5.1.2: How long will the submarine take to be in range of the ship?

The submarine will take 60 seconds to reach the ship's location.

Part 4: Requirements

1.1.1.1: The ship will maintain equal distance from the land mass.

This will reduce any danger presented to the ship during its maneuver.

1.1.1.2: The ship will maintain a constant speed during its maneuver.

This will balance safety and efficiency for the ship and its crew.

1.1.2.1: The ship will reach a set speed before starting the turn.

This will allow for specific and measurable performance during the turn.

1.1.2.2: The ship will reach a set distance from the land mass before starting the turn.

This will ensure that the maneuver can be done safely and accurately before the maneuver starts.

2.1.1.1: The ally aircraft will continue accelerating until it has reached appropriate bombing vicinity of the base.

This will increase the efficiency of the flight path and allow for the aircraft to make as safe of a disengage as possible.

2.1.1.2: The aircraft will maintain a basic flight path until munitions are launched.

This will decrease the time of full execution and increase action efficiency.

2.1.2.1: The aircraft will start at a complete stop before initiating takeoff.

This will allow for precise tracking of the process and goal of the attack when it starts.

2.1.2.2: The aircraft will be given more than sufficient fuel for the round trip.

This will lower the chance of any travel related emergencies.

3.1.1.1: The countermeasure will be able to produce infrared signals capable of deterring multiple missiles.

This will increase the efficiency and safety of how the countermeasure handles the missiles.

3.1.1.2: The countermeasure will notify the pilot when missiles are incoming.

This increases the transparency between working hardware and the user.

3.1.2.1: The countermeasure will activate automatically.

This reduces the potential for human error at the time of crisis, which could be fatal.

3.1.2.2: The countermeasure will have manual activation capabilities.

This will give the pilot the option to deter any emergency threats if sensors are malfunctioning.

4.1.1.1: The bombs will be equipped with proximity fuzes.

This will accommodate for targets of varying size to allow for accurate damage regardless of the target.

4.1.1.2: The bombs will be guided by on-board IR sensors.

This will allow the bombs to locate and track their target efficiently.

4.1.2.1: Bombs will be launched in multiple waves.

This will produce a more effective counterattack.

4.1.2.2: The aircraft will drop the bombs at a constant rate.

This will increase reliability for damage done to the enemy forces and decrease chance for wasted munitions.

5.1.1.1: The depth charges will contain explosive material.

This will cause the most damage possible to the enemy submarine.

5.1.1.2: All depth charges should sink at a consistent speed.

This will increase precision of the attack if executed properly.

5.1.2.1: The depth charges will be equipped with a depth fuze for detonation.

This will allow the charge to detonate at an accurate time based on consistent depth of the submarine.

5.1.2.2: Multiple depth charges will be launched in one attack.

This highly increases the chance of successful hits and maximizes potential damage.

Part 5: Specifications

1.1.1.1.1: The ship will stay ½ mile away from the land mass until the full turn is complete.

This will allow the ship to make an appropriate disengage from its pathing after assessing the further plan of attack.

1.1.1.1.2: The ship will start turning when the very front of the ship reaches the beginning of the land mass's curve.

This will allow the following maneuver to maintain the distance that was specified.

1.1.1.2.1: The ship will keep a speed of 20 knots throughout the entire turn.

This will allow a safe turn while also efficiently approaching the enemy ship.

1.1.1.2.2: The ship will accelerate toward the enemy ship when the full 90-degree turn is complete.

This will allow a timely engagement on the enemy.

1.1.2.1.1: The ship will reach 20 knots before reaching the start of the turn.

This will provide good setup for the maneuver.

1.1.2.1.2: The ship will linearly change speed until it reaches the turn's starting speed.

This is the safest and smoothest way to reach the start speed for the turn.

1.1.2.2.1: The ship will continue moving in a straight line until the start of the turn.

This will allow the execution of the turn to go as safely and accurately as possible.

1.1.2.2.2: The ship will be ½ mile from the land mass before reaching the start of the turn.

This will also provide good setup for the maneuver.

2.1.1.1.1: The aircraft will continue accelerating at a rate of 50 ft/s^2 until it reaches the appropriate vicinity.

This gives an efficient buildup of speed throughout the flight path.

2.1.1.1.2: The aircraft will unload munitions when it is within 300ft of the enemy base.

This will allow the munitions to reliably hit their target and allow the pilot to make a safe early disengage.

2.1.1.2.1: The aircraft will fly in a straight line during its path toward the enemy base.

This will reduce the flight time as much as possible.

2.1.1.2.2: The aircraft will make a disengage maneuver only once it has launched munitions.

Any change in flight path might require a change in speed of the aircraft.

2.1.2.1.1: The aircraft should achieve a speed of 180mph at takeoff.

This will allow the aircraft to have a safe, successful takeoff.

2.1.2.1.2: The aircraft should have approximately 600ft of space to takeoff from.

This will add to the safety and reliability of the aircraft's takeoff.

2.1.2.2.1: The aircraft will be properly fueled before initiating takeoff.

This will prevent any extra intervening from the pilot.

2.1.2.2.2: The aircraft will be given enough fuel to travel 150 miles at the designated speed.

This will allow breathing room for the aircraft to be adequately fueled.

3.1.1.1.1: The countermeasure should be capable of handling up to 12 missiles at a time.

This balances design efficiency and safety.

3.1.1.1.2: The countermeasure will only use one infrared instance per missile.

This will prevent any missile handling collisions that could cause further danger.

3.1.1.2.1: The countermeasure will use infrared sensors to detect incoming missiles.

This is the most effective way of reliably detecting the missiles.

3.1.1.2.2: The countermeasure will be able to detect missiles when they are 200ft away from the aircraft.

This allows the countermeasure to act in a timely manner and notify the pilot accordingly.

3.1.2.1.1: The countermeasure will automatically activate the moment detected missiles are in range.

This will allow automated safety that can handle most cases.

3.1.2.1.2: The countermeasure's automation system will attempt to handle two more than the detected missiles.

This will help mitigate possible errors of undetected rockets by the sensors.

3.1.2.2.1: Manual activation of the countermeasure will attempt to deter the maximum number of missiles (12).

This is the simplest way to prepare for the worst-case scenario on manual activation, especially if the fault is a sensor problem.

3.1.2.2.2: Manual activation shall override automatic activation.

Power to the user over power to the system.

4.1.1.1.1: The proximity fuzes will detonate when the bomb is 5 ft away from a target.

This will balance effectiveness and reliability of the detonation.

4.1.1.1.2: The proximity fuzes will be located on the noses of the bombs.

This will allow for the most accurate detonation time, given the fuze type.

4.1.1.2.1: Each bomb will contain one IR sensor.

This is deemed adequate for collecting sufficient information.

4.1.1.2.2: Each bomb's IR sensor will be located on the nose.

This will be the best place for the sensor to collect information for the steering mechanism.

4.1.2.1.1: Bombs will be launched in two waves, one going forward and one coming back.

This will balance the effectiveness of the counterattack with time spent in the air.

4.1.2.1.2: 5000 kg of bombs will be launched per wave.

This produces a cost-effective counterattack.

4.1.2.2.1: The aircraft will drop 500 kg of bombs per second each wave.

This gives enough munitions for doing damage without waste.

4.1.2.2.2: Each wave will last 5 seconds.

This is calculated based on the total amount of bombs and amount dropped per second, given there are two waves.

5.1.1.1.1: Each depth charge will contain 200kg of explosive material.

This balanced cost efficiency of each charge, doing high potential damage without wasting too much if missed.

5.1.1.1.2: The depth charge will create a high-pressure chemical reaction.

This is the most cost-effective way of doing underwater damage to a vessel.

5.1.1.2.1: Each depth charge should drop at approximately 4.5m/s.

This gives an efficient yet reliable speed for the charges to reach their destination.

5.1.1.2.2: Each depth charge should take 33 (+/- 1) seconds to reach the target depth.

Purely based on calculations between drop speed and depth target.

5.1.2.1.1: The depth fuze will be located on the bottom size of each charge.

This provides the most accuracy for the detonation depth of the charge to have a higher chance of hitting.

5.1.2.1.2: The depth fuze will be set to detonate at 150m.

This is the detected consistent depth of the target submarine.

5.1.2.2.1: A total of 10 depth charges will be launched.

This will decrease chances of error and increase chances of successful attack.

5.1.2.2.2: The depth charges will be dropped every 1 second, starting 2 seconds before the target time frame and ending 8 seconds after the target time frame.

This will account for any uncontrollable circumstances to allow for more reliability, as well as account for the submarine's length to cause spread damage.

Part 6: Requirement Verification

1.1.1.1.A.1: Did the ship maintain equal distance from the land mass throughout the turn?

1.1.1.2.A.1: Did the ship maintain constant speed during the turn?

1.1.2.1.A.1: Did the ship reach a set speed before reaching the turn?

1.1.2.2.A.1: Did the ship reach a set distance from the land mass before reaching the turn?

2.1.1.1.A.1: Did the aircraft continue accelerating throughout its entire flight path?

2.1.1.2.A.1: Did the aircraft maintain a basic flight path until munitions were launched?

2.1.2.1.A.1: Is the aircraft at a complete stop before starting takeoff?

2.1.2.2.A.1: Is the aircraft adequately fueled?

3.1.1.1.A.1: Can the countermeasure deter multiple missiles?

3.1.1.2.A.1: Does the countermeasure notify the pilot when missiles are incoming?

3.1.2.1.A.1: Does the countermeasure activate automatically?

3.1.2.2.A.1: Does the countermeasure have manual activation capabilities?

4.1.1.1.A.1: Do the bombs have proximity fuzes?

4.1.1.2.A.1: Do the bombs have on-board IR sensors?

4.1.2.1.A.1: Are the bombs launched in multiple waves?

4.1.2.2.A.1: Are bombs dropped at a consistent rate?

5.1.1.1.A.1: Do the depth charges contain explosive material?

5.1.1.2.A.1: Do the depth charges sink at a consistent speed?

5.1.2.1.A.1: Are the depth charges equipped with a depth fuze?

5.1.2.2.A.1: Are multiple depth charges launched in one attack?

Part 7: Specification Verification

1.1.1.1.1.1: Did the ship stay 2 miles away from the land mass during the entire turn?

1.1.1.1.2.1: Did the ship start turning when its front reached the edge of the land mass?

1.1.1.2.1.1: Did the ship maintain a speed of 20 knots during the entire turn?

1.1.1.2.2.1: Did the ship start accelerating toward the enemy ship once the turn was complete?

1.1.2.1.1.1: Did the ship reach 20 knots before reaching the start of the turn?

1.1.2.1.2.1: Did the ship linearly change speed before reaching the turn starting point?

1.1.2.2.1.1: Did the ship continue moving in a straight line until reaching the start of the turn?

1.1.2.2.2.1: Was the ship 2 miles away from the land mass when it started the turn?

2.1.1.1.1.1: Is the aircraft accelerating at 50ft/s^2 during its flight path?

2.1.1.1.2.1: Did the aircraft unload munitions within 300ft of the enemy base?

2.1.1.2.1.1: Is the aircraft flying in a straight line during its flight path?

2.1.1.2.2.1: Did the aircraft wait until munitions were launched to disengage?

2.1.2.1.1.1: Is the aircraft at a speed of 180mph at takeoff?

2.1.2.1.2.1: Does the aircraft have 600ft of space to takeoff from?

2.1.2.2.1.1: Is the aircraft fueled before takeoff?

2.1.2.2.2.1: Can the aircraft travel 150 miles with the fuel it has?

3.1.1.1.1.1: Can the countermeasure handle up to 12 missiles at a time?

3.1.1.1.2.1: Does the countermeasure use one infrared instance per missile?

3.1.1.2.1.1: Does the countermeasure use infrared sensors?

3.1.1.2.2.1: Can the countermeasure detect missiles 200 ft away?

3.1.2.1.1.1: Does the countermeasure activate the moment missiles come into range?

3.1.2.1.2.1: Does the countermeasure's automation system attempt to handle two more missiles than detected?

3.1.2.2.1.1: Does manual activation of the countermeasure attempt to handle 12 missiles?

3.1.2.2.2.1: Does manual activation override automatic activation?

4.1.1.1.1.1: Do the proximity fuzes detonate when the bomb is 5 feet away from the target?

4.1.1.1.2.1: Are the proximity fuzes in the nose of the bombs?

4.1.1.2.1.1: Does each bomb have one IR sensor?

4.1.1.2.2.1: Are the IR sensors on the nose of the bombs?

4.1.2.1.1.1: Are the bombs launched in two waves?

4.1.2.1.2.1: Is 5000kg of bombs launched each wave?

4.1.2.2.1.1: Is 500kg of bombs dropped per second?

4.1.2.2.2.1: Does each wave last 5 seconds?

5.1.1.1.1.1: Does each depth charge contain 200kg of explosive material?

5.1.1.1.2.1: Do the depth charges create high-pressure chemical reactions when detonated?

5.1.1.2.1.1: Does each depth charge drop at 4.5m/s?

5.1.1.2.2.1: Does each depth charge take 33 +/- 1 seconds to reach the target?

5.1.2.1.1.1: Are the depth fuzes located on the bottom of the charges?

5.1.2.1.2.1: Are the depth fuzes set to detonate at 150m?

5.1.2.2.1.1: Is a total of 10 depth charges set to be launched?

5.1.2.2.2.1: Does a depth charge get launched every 1 second, and do they get dropped in the given 10 second time frame?