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ADVANCED REACTOR SAFEGUARDS & SECURITY

Safeguards and Security for Maritime Applications

PRESENTED BY

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Background

- Floating Nuclear Power Plants (FNPPs) are being considered for a variety of applications
  - Stationary offshore plants for remote applications
  - Mobile plants able to provide power as emergency relief for natural disasters
  - Clean energy propulsion for cargo ships
  - Floating charging stations for battery powered vessels

- FNPPs will need unique physical protection systems (PPS) to meet their unique needs

Challenges to Security Design for FNPPs

- Water based attacks – vessel or submerged
  - Detection methods
  - Physical protection design

- Balance between effective and practical protection
  - Ex: When considering a homemade sub-aquatic missile: is an underwater fence or net enough, or will there need to be a submerged concrete fence or a man-made cove surrounding the FNPP?

FNPP Layout

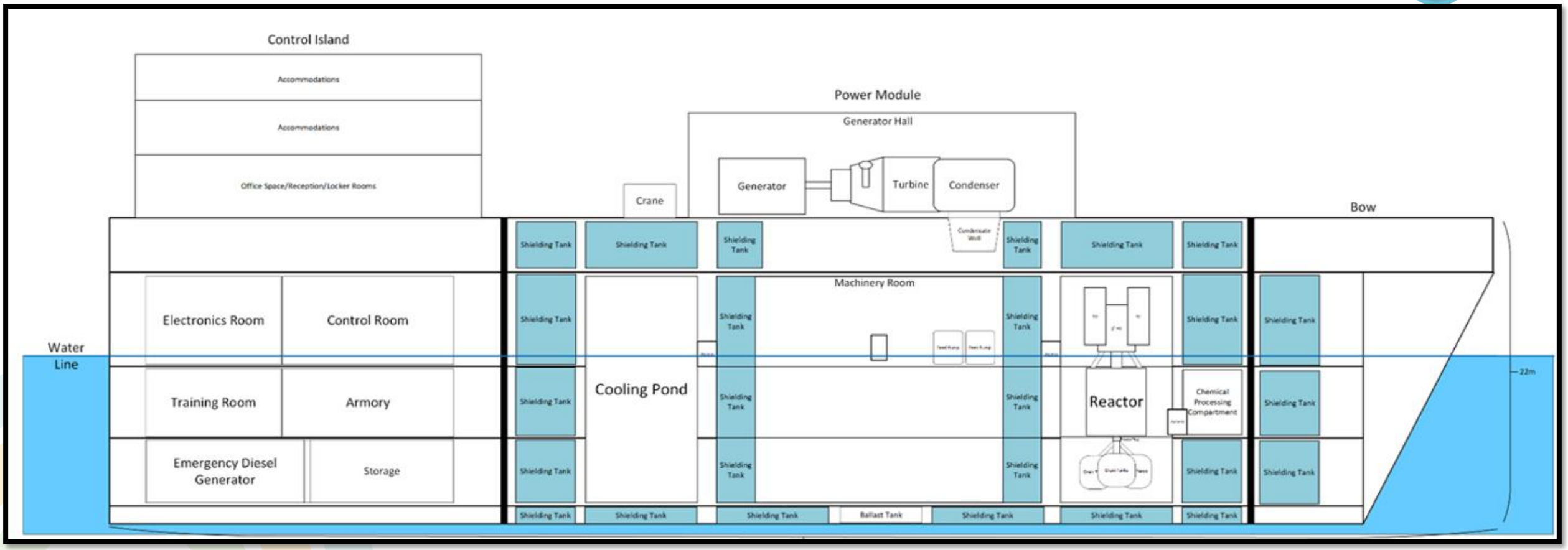

Figure 1. Notional FNPP Layout

Preliminary PPS Design

- Assumptions:
  - Strict reliance on off-site response
  - Adversary has knowledge of FNPP layout
  - Adversary taking most vulnerable path from dock to target

- Current delay methods:
  - Barriers – fence surrounding ship, steel doors, lead walls
  - Cameras – located in entry points, stairwells, and along the main deck
  - Patrol – along the main deck

First Iteration of PPS Design

Initial Design:

- Chain link fence around the main deck
- Steel walls of varying thickness around the different units and rooms
- Steel doors
- Shatter-proof windows on main deck for operators' quality of life
- Reinforced concrete around cooling pond and reactor

Results of Initial Design:

- Probability of detection for all 3 scenarios was 1.
- Offsite response was too slow with the given delays in the system

Current Iteration of PPS Design

Changes Made

- Removed all windows
- Upgraded all doors to 10 cm wood with metal sheeting
- Upgraded doors to vital areas to 30 cm wood with metal sheeting or steel and concrete rolling doors
- Increased thickness vital area walls

Results for current design

- Probability of detection for all scenarios is 1
- Added delays significantly aided response force

Conclusions so far:

- Relying on off-site response force requires lots of built in delay for an effective design
- A response force located on board is likely going to be required
- More iterations can significantly improve the design

Future Work

- Refine PPS design to find balance between effective and practical protection
  - Offsite vs Onsite Response
  - Economic Analysis
  - Force on Force simulation
- Expand analysis to include water-based attacks
  - Scribe3D needs a boat
  - Work with sensor development to discuss best monitoring options to detect submerged and vessel adversaries

References

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