**Why Amphibian?**

* Aerial vehicles, particularly helicopters.
  + They can’t go house by house (Localisation)
    - The Minimum Height it can go is 500 feet.
  + Are vulnerable to wind conditions
  + Power lines, trees, and overhanging debris
* Conventional boats too have only limited accessibility. After a point called the hot zone (Disaster zones) they must risk divers
  + Hence, they can send those ROV into various houses in a particular block which can go house to house and collect those issues to the boat. And from the boat, they can send in the deliverables.
* Conventional ROV is limited to only water-based travel. While flood transportation requires a vehicle which is
  + Dynamic to changes in the environment
  + Can enter inside the flooded houses

**Fundamental Problems and Open Issues in Rescue Operations**

**Case Study**

**1. Chennai Flood**

* First responders faced difficulties in providing accurate real time information to local communities on flooded areas, accessibility of roads, road condition, traffic flow and current weather scenario
* Flood water entered the first level of most of the offices and shops, reaching a height of approximately two meters in some areas.
* Community-Based Organizations (CBOs) faced tough challenges, such as contingency planning at zone/ district level, stock piling of relief materials/supplies, arranging for inter-agency coordination, preparing evacuation plans, providing public information and conducting field exercises.
* Situation worsened due to lack of mechanisms to mitigate impacts of flood, such as road closure notification, absence of traffic control warning signs, emergency detour routes, etc.
* Medical doctors may not be permitted inside the hot zone, which can extend for kilometres

**Challenges While Designing Robots**

* How to make rescue robot operations more efficient to find more survivors or provide more timely information to responders.
* Pre-mission preparation (e.g., how long does it take to set up the robotsystem), mission execution, and post-mission activities (e.g., how long does it take to change batteries, decontaminate, inspect for wear, or perform minor repairs,etc.)
* GPS reception and underwater vehicles cannot receive GPS signals.

**How can we Contribute**

* Robot carriers that are attached with huge compartments to keep essentials
* In-house views are captured through cameras which can give live audio commands from doctors for medications
* Database Systems which has information about the particular locality. It contains info about
  + House number
  + Individual’s requirements
  + What have they received so far
* Enhanced locomotion techniques to travel in various kinds of rough terrains
* Seamless Communication from the bot to the central hub (Possibly to the boat)

**References**

1. Chennai Flood: <https://www.mei.edu/publications/2015-chennai-flood-case-developing-city-resilience-strategies>
2. Research Paper: <https://www.researchgate.net/publication/225916883_Search_and_Rescue_Robotics?enrichId=rgreq-93dc4acbda2837583c88f208f1f8b2c1-XXX&enrichSource=Y292ZXJQYWdlOzIyNTkxNjg4MztBUzoxMDQ2MjEyOTI5MTY3MzlAMTQwMTk1NTA2ODM4MQ%3D%3D&el=1_x_2&_esc=publicationCoverPdf>

**Military Stealth Operations**

**Materials**

* After the invention of electromagnetic meta surfaces, the radar waves can be scattered.
* Two types of meta surfaces (i) checkerboard meta surfaces, (ii) gradient index meta surfaces.
* **Negative index metamaterials** are artificial structures for which refractive index has a negative value for some frequency range, such as in microwave, infrared, or possibly optical. They reduce detectability and may provide electromagnetic near invisibility in designed wavelengths.
* **Dielectric composite materials** are more transparent to **radar**, whereas **electrically conductive** materials such as **metals and carbon fibers** **reflect electromagnetic energy** incident on the material's surface.
* Radiation-absorbent material (RAM), often as paints absorb radiated energy from a ground and convert it to heat.

**Vehicle Shape**

* Parallel alignment of edges: The technique involves using a **small number of edge orientations** in the shape of the structure. The effect of this is to return a narrow radar signal in a very specific direction
* One method to reduce helicopter rotor noise is **modulated blade spacing**. Standard rotor blades are evenly spaced and produce greater noise at a given frequency and its harmonics.

**Acoustics**

* Submarines use extensive **rubber mountings** to isolate, damp, and avoid mechanical noises

Paints

* Most stealth aircraft use **matte paint and dark colors.**
* Yehudi lights. Yehudi lights are lamps of automatically controlled brightness placed on the front and leading edges of an aircraft to raise the aircraft's luminance to the average brightness of the sky

**Challenges and Risks in Implementing Stealth Tactics**

1. **High Costs**:
   * Developing and maintaining stealth technology (e.g., aircraft, radar-evading materials) is expensive.
   * Financial strain limits widespread adoption due to budget constraints.
2. **Operational Security Risks**:
   * Compromises in intelligence or operational details can jeopardize missions and endanger personnel.
   * Strict confidentiality is essential to maintain the element of surprise.
3. **Complex Training Requirements**:
   * Personnel require specialized skills in infiltration, reconnaissance, and guerrilla warfare.
   * Intensive training and practice are necessary for mission success.
4. **Adapting to Evolving Countermeasures**:
   * Enemy advancements in detection technologies pose constant threats.
   * Innovation and strategic adjustments are crucial to overcome vulnerabilities.