

The Search and Rescue Problem

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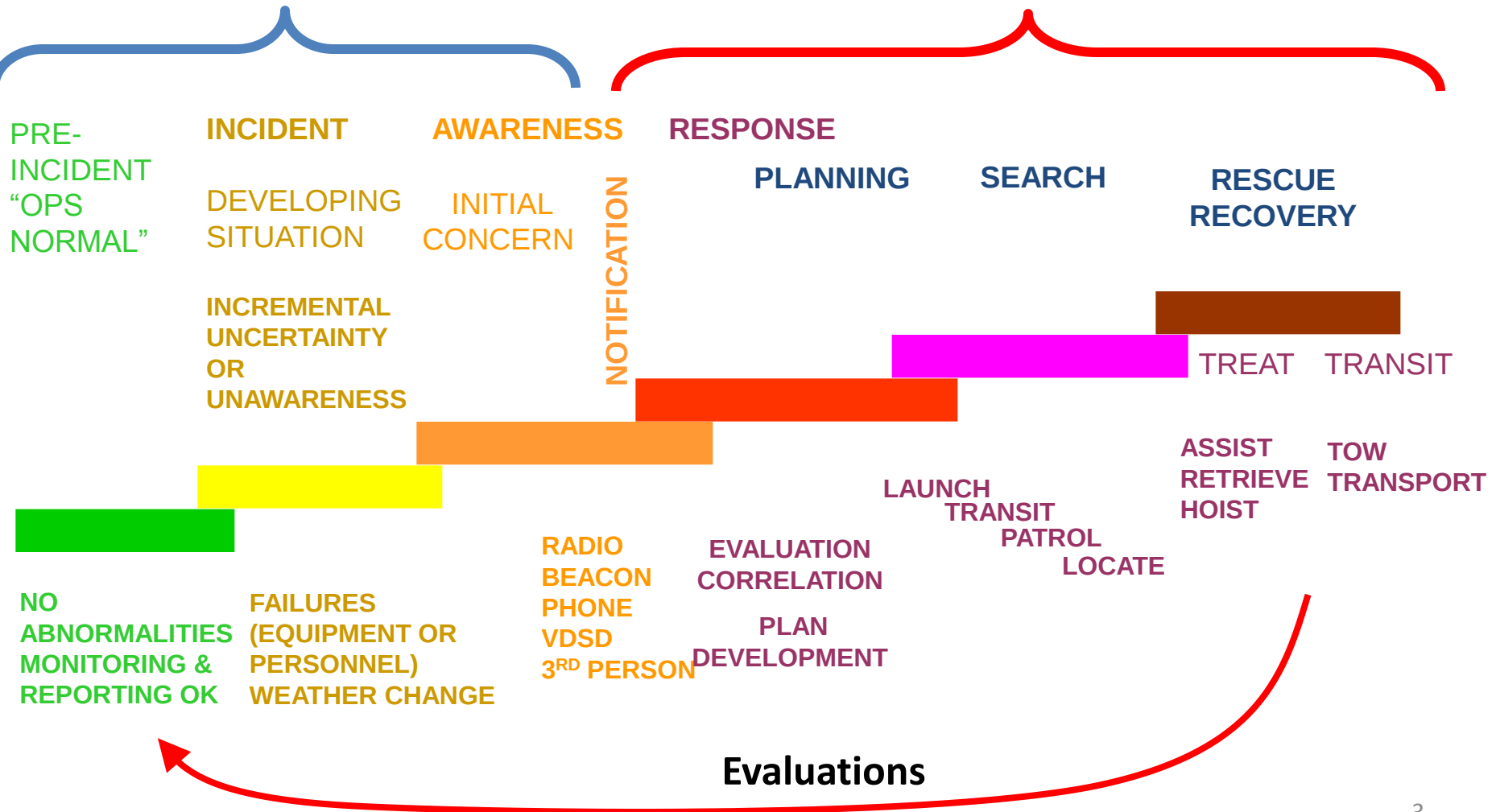
That required talk overview slide

- The BIG SAR picture
- My little piece of it
- What goes into a SAR case
- What about oil spill cases?
- How can Met/Oceanographers help?
- Some possible next steps....
- SAROPS examples (later over beers?)

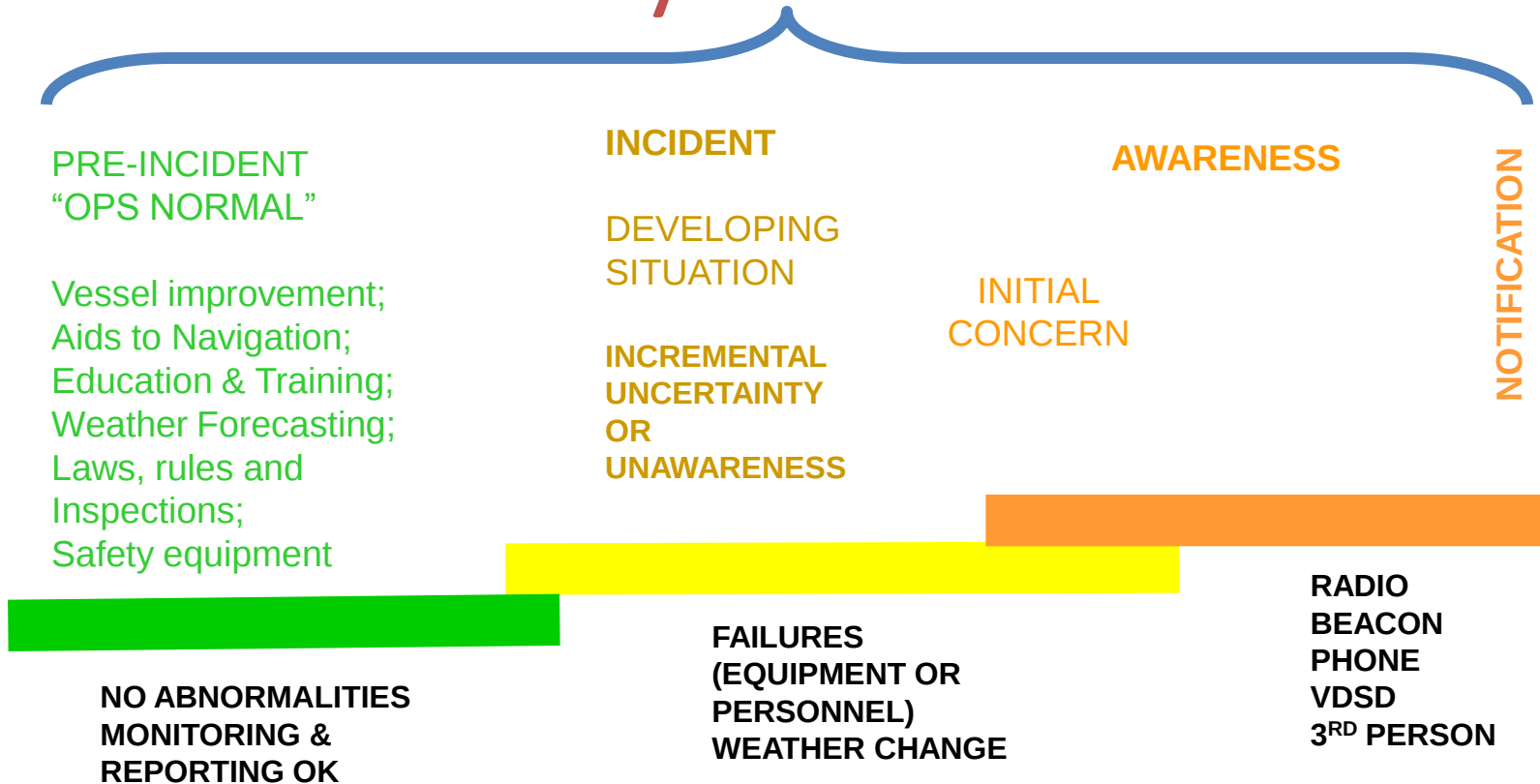
Pre-Incident thru Response Paradigm

Safety & Prevention

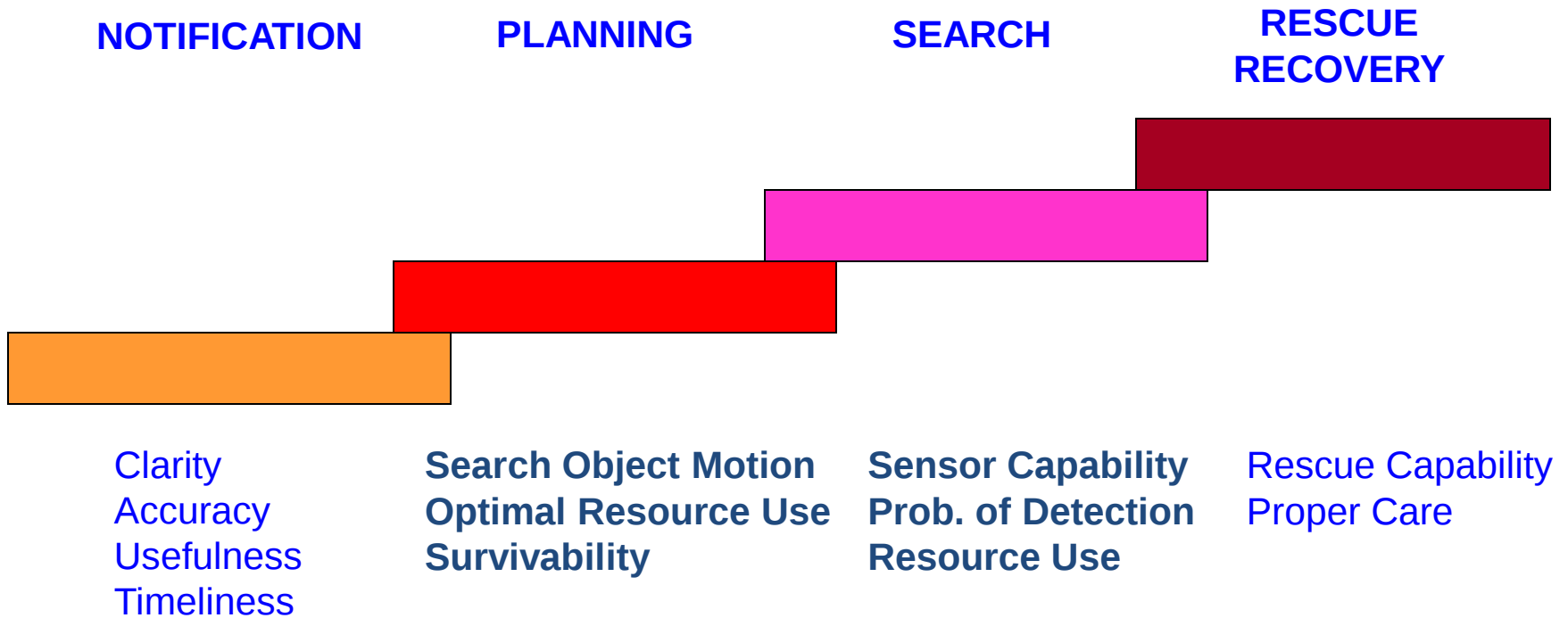
Response



Safety & Prevention



SAR Response Process



The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
- Promulgate the search plan
- Perform the search plan
- Evaluate the completed search
- Repeat above until survivors are found and rescued or case is suspended.

The Oil Spill Case

- Create an Oil Spill case when alerted
- Gather data, estimate uncertainties, ~~create scenarios~~
- Use models to determine search area, weathering, and impact areas
- Estimate resource availability and capability
- Plan and optimize the next search and mitigation
- Promulgate the search and mitigation plan
- Perform the search and mitigation plan
- Evaluate the completed search and mitigation
- Repeat above until oil impacts are mitigated.

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
 - Who is trouble?
 - Where and when did they get in trouble?
 - What, where, and when: before the incident?
 - What are we looking for?
 - Bounds on What, Where, and When
 - Possible sequences of events = 1st scenario
 - However, “Or they did this” = 2nd scenario
 - Weight all to reflect the probabilities

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
 - Surface currents for area from time of incident to search
 - Surface (10-meter) winds for area
 - Leeway (% and direction relative to wind) for each object
 - Uncertainties of wind, currents, and leeway
 - Survival time and Sea Surface Temperature
 - New probability density distribution for the search area

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- **Estimate resource availability and capability**
 - Aircraft and vessels ready to go, near-by
 - Aircraft and vessels that can be made ready
 - Sensors, endurance, and speed = coverage
 - Sensor capabilities pre determined (POD as $f(LR)$) = LRC

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
 - Account for all previous searching
 - Account for relative motion between object and searcher
 - Account for operational constraints (weather, turning, navigation, overlaps)

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
- **Promulgate the search plan**
 - FAX, radio call, data message

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
- Promulgate the search plan
- **Perform the search plan**
 - Fly the plan, sail the plan, look at the windows for hours on end
 - Divert to ID possible survivors

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
- Promulgate the search plan
- Perform the search plan
- **Evaluate the completed search**
 - Actual vs. planned search pattern
 - Input actual into SAR planning tool

The Search & Rescue Case

- Create a SAR case when alerted
- Gather data, estimate uncertainties, create scenarios
- Use models to determine search area and survivability
- Estimate resource availability and capability
- Plan and optimize the next search
- Promulgate the search plan
- Perform the search plan
- Evaluate the completed search
- Repeat above until survivors are found and rescued or case is suspended.
 - Rescue and transport to definitive care
 - Suspend case based upon exceeding survival time & resources

How can we help?

- SAROPS is available internationally
 - But is a thick client option, w/ commercial parts
 - Thin client web SAROPS in development
- Met / Ocean operational models outputs connections to SAR/oil models ahead of time.
- On scene observations to verify models
- Standard leeway and detection experiments
- Support during cases

What Met / Ocean parameters are needed for SAR/ oil models?

1. Drift: Surface currents, 10-m winds, uncertainties
2. Fate: SST, Air Temp, waves, Rel humidity
3. Detection: waves, visibility, precipitation, relative humidity
4. Operations: waves, winds, visibility

Operational Constrains

- Data availability in less than a minute (SAR)
- Confidence in the Data either grows or is destroyed
- Uncertainty, on scene obs, ensembles can all address data confidence
- Your inputs are just that, not the end game.

Safer Seas III Main Themes

10-13 May 2011, Brest, France

- **Policies, regulations, technological innovations & operational means: - Erika, IT & Comms, containers, ship dismantling, rescue**
- **Climate change and its stakes for maritime shipping and navigation - emissions & waste; new routes**
- **Geo-strategic context & maritime security – piracy, smuggling, trafficking**

Safer Seas III workshops

- **Search and Rescue**
- **My Ocean” / “GMES Mercator**
- **Info fusion & GIS**
- **Geospatial Semantics**
- **Marine Biominetics**
- **Renewable energy**
- **Littoral 3-D**
- **e-ATON**
- **Public order at sea**
- **Civil security, tech risks, crisis handling**

SAR cases in SAROPS

- AF447 reverse drift of bodies to narrow underwater search area for Flight Data Recorders
- NFL case: what is the leeway of capsized boat?
- Gulf of Mexico Cat 23 case: the value of SLDMBs to provide surface currents