Reducing the Time for Deploying new ATRs

Matthew Merzbacher

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GOAL

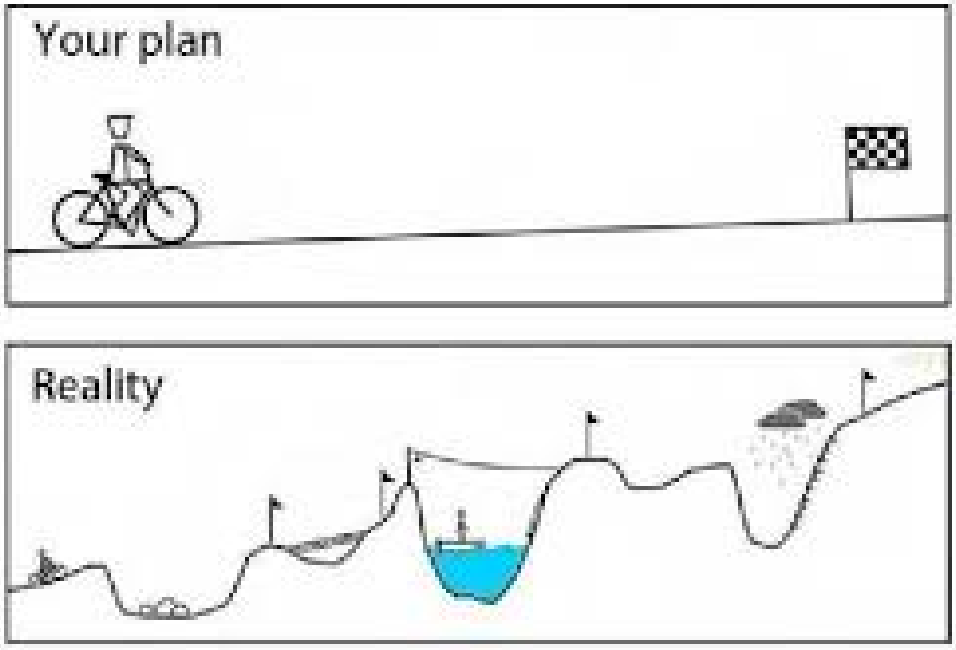
- **Benefit to TSA: Faster deployment of advances in detection**
  - Respond quickly to evolving threats
  - Improve P_D/P_{FA}
  - Improve on-screen resolution
  - Provide better downstream data for alarm resolution
- **What are the barriers and what can be done?**
- **Problem: Current Fielding of ATR is extremely slow**
  - Performance validation is not the big problem!

EDS CASE STUDY

- **RAD / UltraFAR**
  - Reduce FAR by half while keeping as much detection as possible… Quickly!
- **Approach: Tuning Iterations and feedback using Emulators [Agilish]**
- **What worked**
  - Five iterations in 3 months (three iterations assessed at TSL)
- **What didn't work**
  - Moving target (first iteration lost "too much")
  - Deeper changes left off table in rush to iterate
- **What maybe worked**
  - No final requirement meant…
    - Capability determines requirement
    - Easier to declare victory
  - Policy changes stalled field test

WHY IS IT SO SLOW?

- **Long delays from Problem ID to Go**
- **ATR Development is not slow**
  - Varies depending on task
- **Internal testing / integration takes a little longer**
  - Statistical Validation
  - Putting the algorithm on the scanner (architectural challenge)
- **Testing Time takes still longer**
  - Performance Testing (emulators!)
  - **Impact Testing is hard/slow**
- **Fielding takes <u>much</u> longer**
  - No “Big Switch” (a good thing)
  - Policy involved



- **Another Example: RTM**
  - Specification: <long>
  - Internal Development: < 1 year
  - Regulatory Testing (multiple regulators): 6 months
  - Field: 7-12 years (and counting)

PROPOSAL: PUT THE CART BEFORE THE HORSE

- **Instead of developing algorithms and then fielding them, let's…**

  Field algorithms and then develop them!

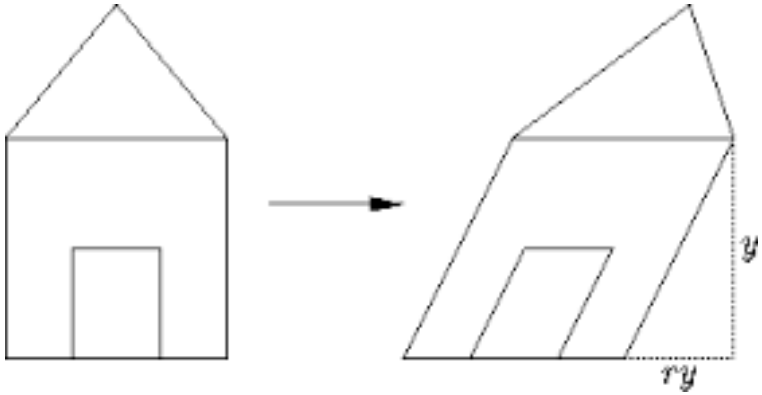
- **Allows us to start working on the policy and architecture issues now!**

- **Can we adapt algorithms in the field when necessary?**
  - How would this work?

BULK DETECTION APPROACH

➔ Target Definition:

- Density Range ($\rho_1 - \rho_2$) and Atomic Number Range ($Z_1 - Z_2$)
- Minimum Mass (m)
- Configurations & Concealments
- Desired Detection (P_D, P_{FA})



➔ Quickly Achievable

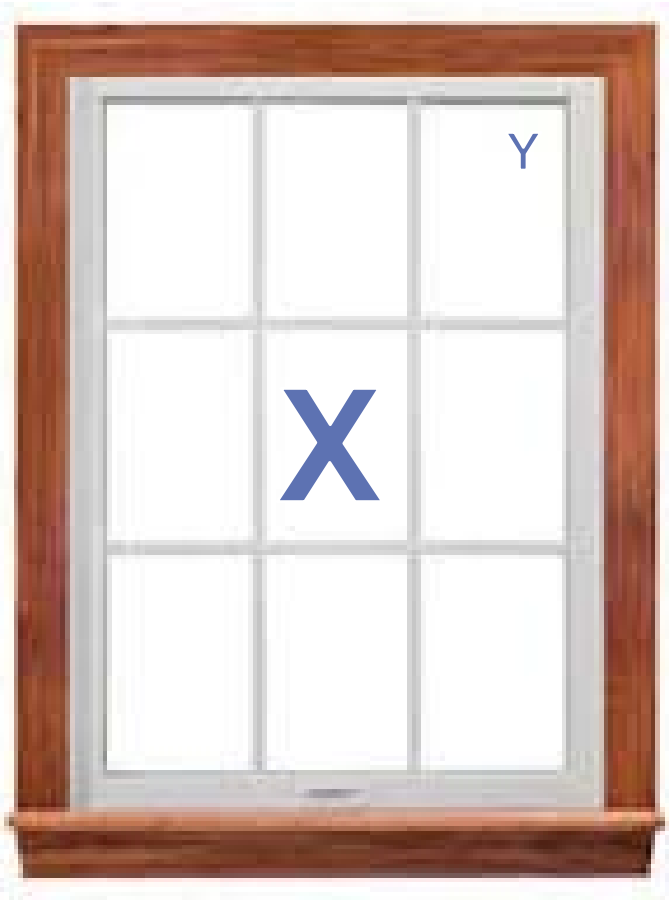
- Open a window in CT value and Z_{eff}
- Requires straightforward transfer function from target definition to window
  - CT is probably *close to* density
  - Z_{eff} is probably *close to* Atomic Number
  - Estimated Mass is probably *close to* Mass
- FA estimates against internal databases provide a good estimate of impact

TECHNICAL CONCERNS

- **Presumes transfer function works across entire domain**
  - Can be pre-validated for areas of potential interest
- **Transfer function is not “affine” beyond CT , Z, and estimated mass**
  - Special cases will break for configurations and concealments
  - Sheets (and some bulks) are hard
    - Thinness and bendiness adds complexity
  - ATR may use additional features / morphology: more features mean more trouble
  - Even for those CT/Z/m, the transfer function is not perfectly “affine”
- **How can we know quickly when detection doesn’t track well? And what’s “good enough”?**

OTHER CHALLENGES

- **Requirements: Defining / Controlling the windows is critical**
  - Is everything equal inside the window?
  - How does that affect transfer?
- **Operational impact hard to assess in advance**
  - OSR and other downstream resolution
- **ATR development issues are easier to solve than:**
  - Update strategy (Networking)
  - Control & Command – avoiding exuberant local personnel?
  - Policy concerns



FINAL IDEA [IF TIME PERMITS]

- **Windows are not currently associated with specific materials**
- **Could identify one (or more) windows for each material**
  - Windows overlap
  - Detection becomes a logical “or”
  - Allows independent development on a material-by-material basis
  - Challenges in presentation of results
- **Allow material-level fusion with other technologies**
  - If they grok the same materials
- **Maybe DICOS can help!**

SUMMARY

- **Need faster deployment of advances in detection**
  - Respond quickly to evolving threats
  - Improve P_D/P_{FA}
  - Provide better downstream data for alarm resolution (human & non-human)
- **Testing/Validation is not the time-consuming part!**
- **Technical issues are easier than requirements, control & policy issues**