

Moving INLAND SAR into the 21st Century

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Outline

- What did ISAR & MSAR learn along the way?
- A rough Timeline – Getting to MLPI 2nd ed.
- Thanks Jack! Chapter 15 “POD” the Key.
- Timing is Everything!

Inevitability

“The Present seems Inevitable only
when you get there.”

(Me)

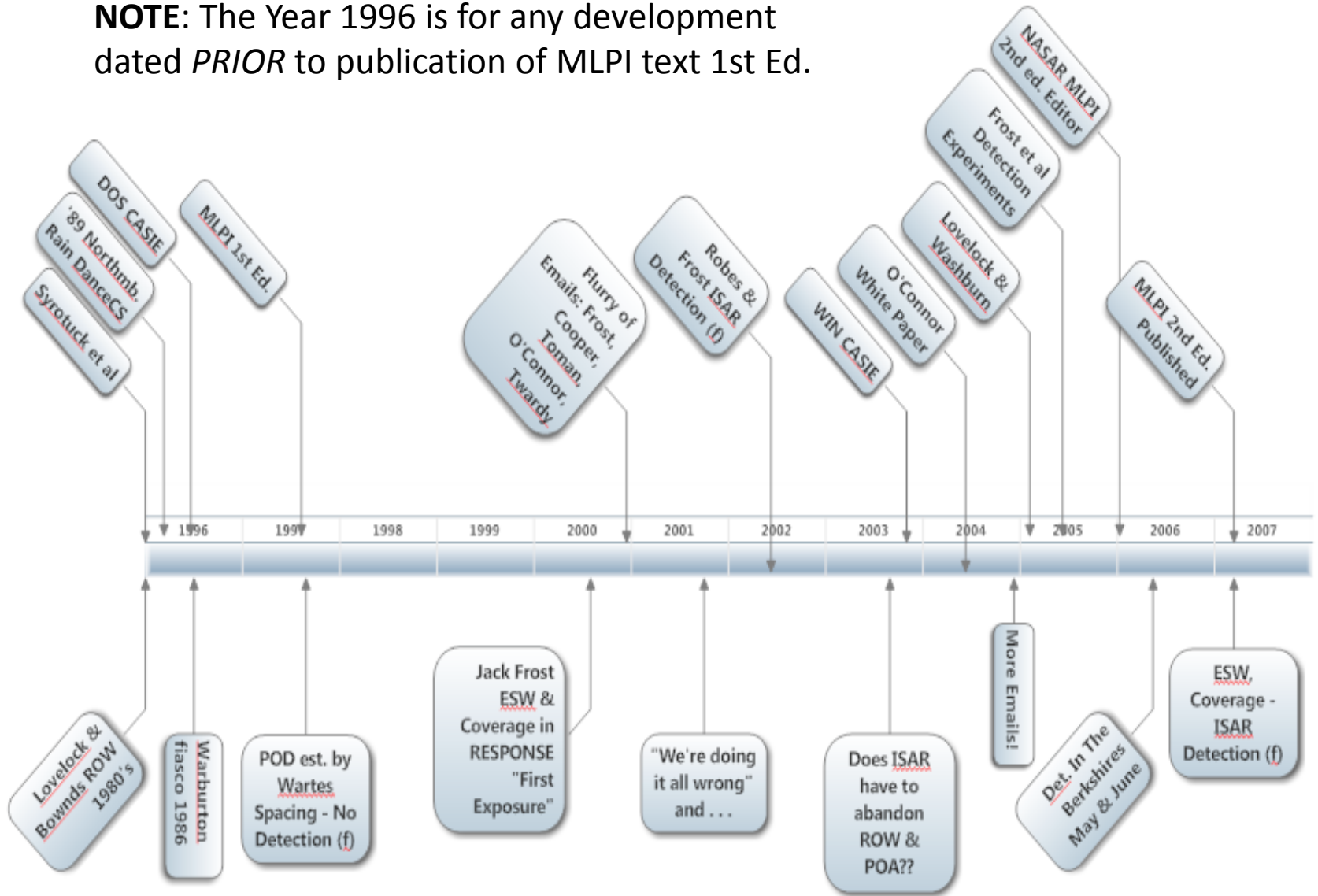
Some Working Definitions

- MSAR – Maritime SAR, or as done over water
- ISAR – Inland SAR, or as done over land
- POC – Probability of Containment (MSAR)
- POA – Probability of Area (ISAR)
- ROW – Rest Of the World (ISAR)

1997 1st Ed. MLPI

- POD based on Wartes formula
- No Detection Function
- Spacing determined POD for a Mouse or an Elephant
- Best estimate we had at the time . . .

NOTE: The Year 1996 is for any development dated *PRIOR* to publication of MLPI text 1st Ed.



By 2007 MLPI 2nd Edition

New Concepts In ISAR Mgmt Course

- Effective Sweep Width
- Coverage as a function of ESW
- The Exponential Detection Function
- POD as a function of Coverage

By 2007 MLPI 2nd Edition

3- Ways for ISAR to get ESW

- Eco Table ESW from Detection Experiments
- AMDR sampling and conversion to ESW
- Critical Separation (CS) and conversion to ESW
- See also 3-Chart handout for CS & AMDR

Determining Grid Spacing from Critical Separation

Chart 1: Convert CS to est. ESW

Chart 2: Select Desired Coverage

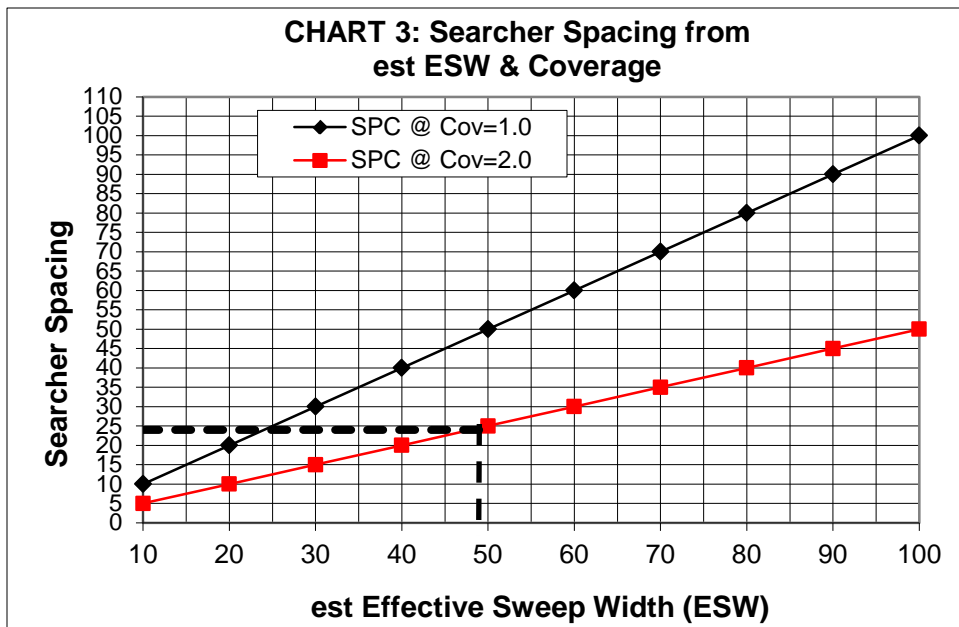
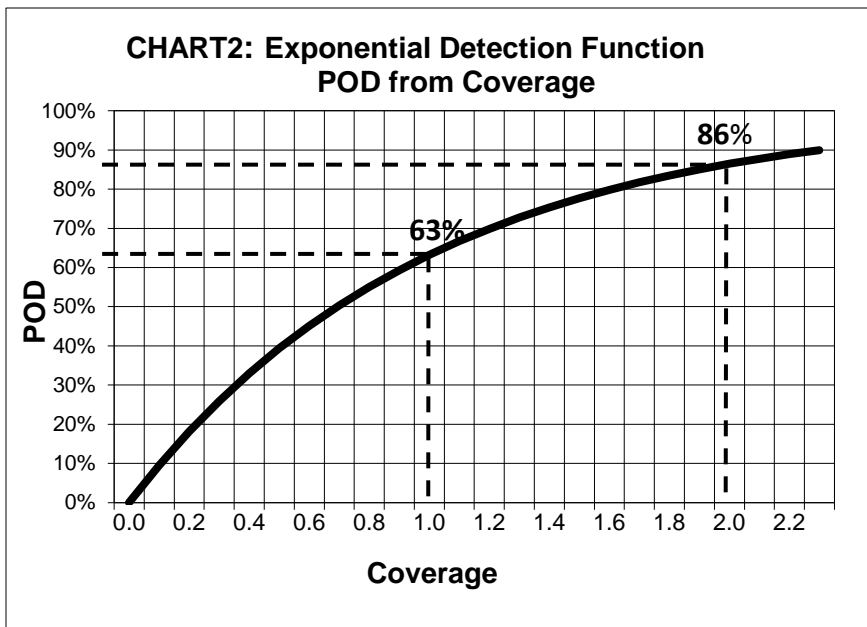
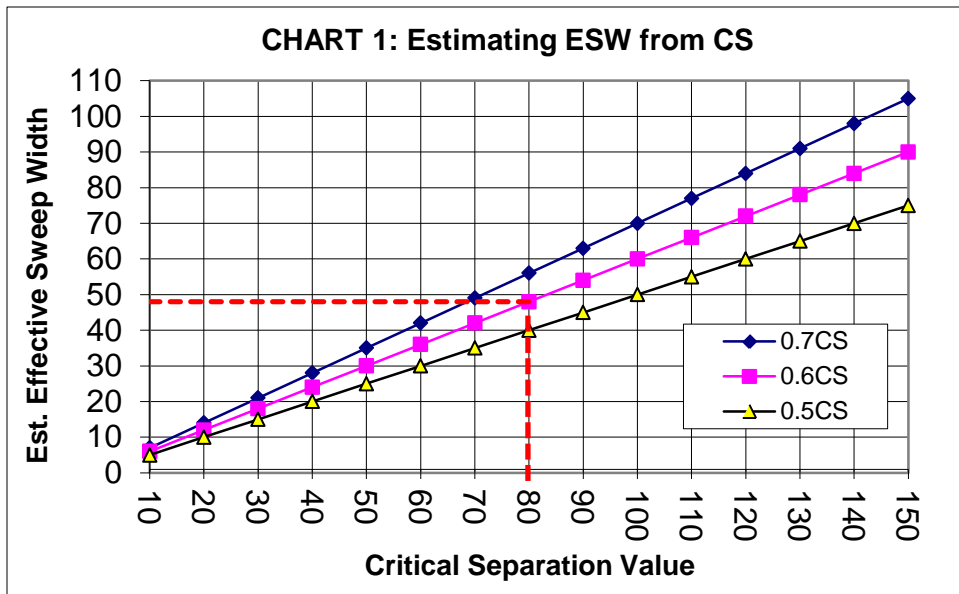
Chart 3: Obtain Spacing

Example:

For a CS of 80 @ 0.6 → est ESW=48;

for 86% POD → Coverage=2, & Spacing = 24.

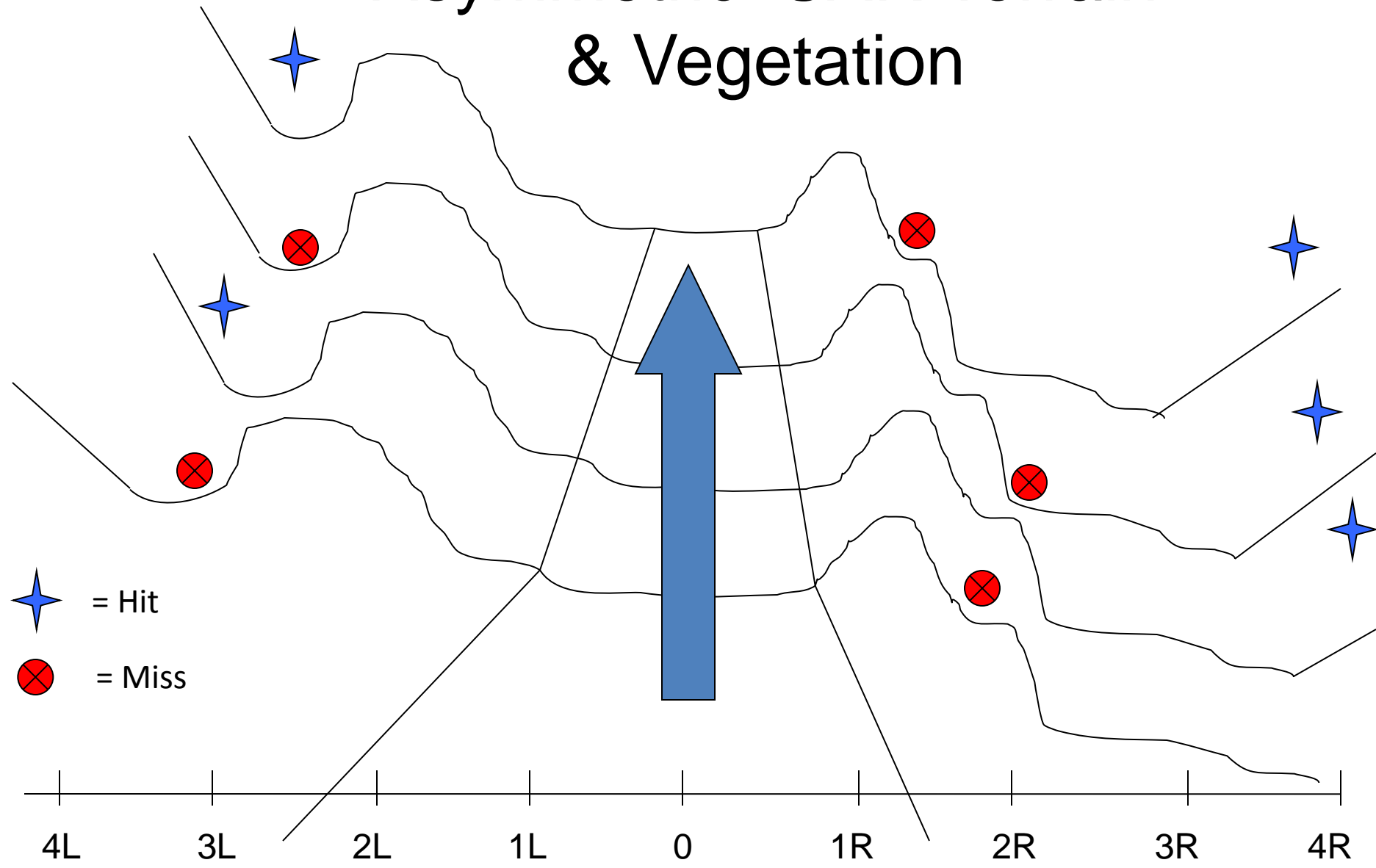
(Note: for AMDR, skip Chart 1; multiply AMDR by 1.5 to calculate est ESW, then use Charts 2 & 3)



By 2014 . . .

- No More Detection Experiments for ISAR
- AMDR sampling and conversion to ESW
- Critical Separation (CS) and conversion to ESW
- “Because of the complexities of the Land environment, search planners need a way to estimate the value of W (ESW) without conducting formal experiments.” (Koester, Twardy, Chiacchia, Cooper, Frost & Robe)

Asymmetric ISAR Terrain & Vegetation





Fall (Sign is down)



“Those damn ferns!”



Winter (Sign is up! Not a fern in sight)

Detection in the Berkshires. June (Sign is up)

The Complexity of the Ever-Changing LandSAR Environment



Spring (May 2nd)

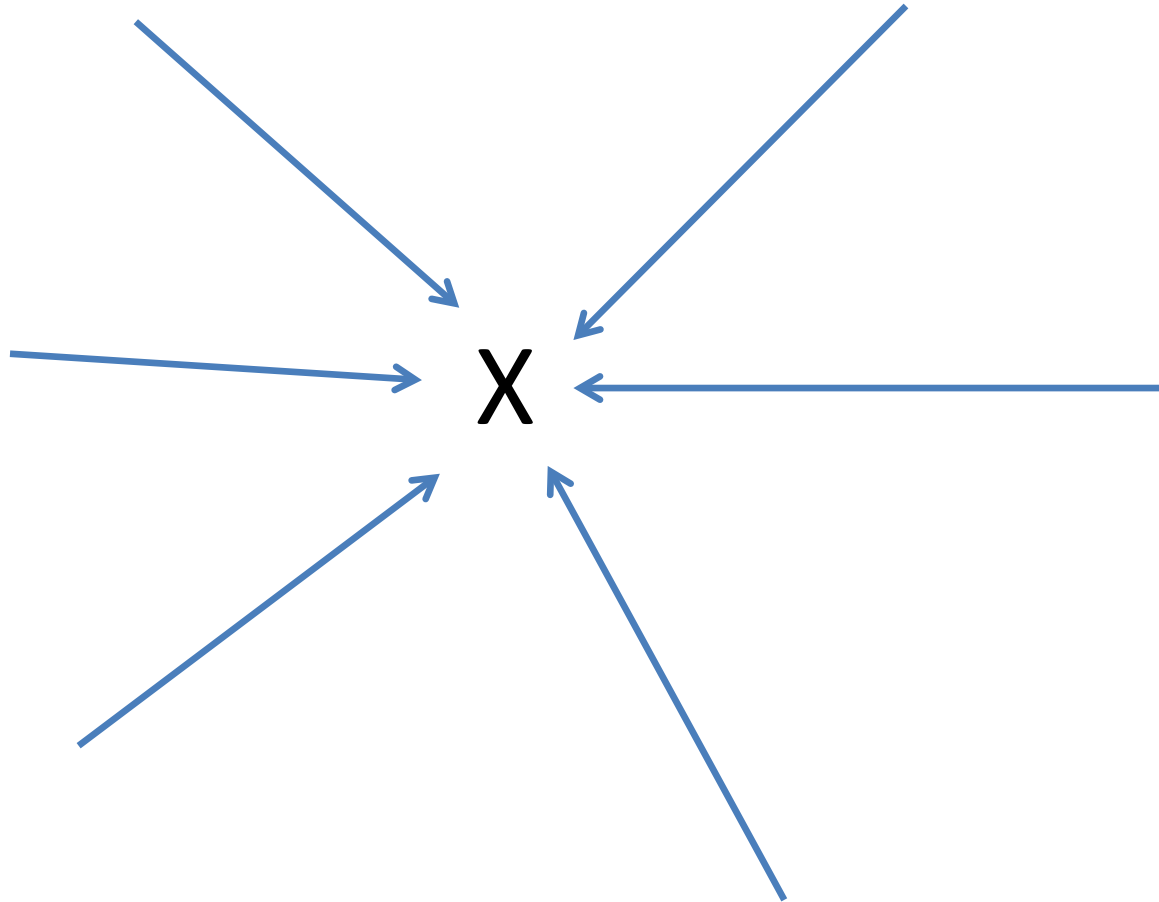
Mt. Greylock base trail,
Berkshires, MA – Various Seasons.

Source: Rick Toman (2006)

Was it worth it?

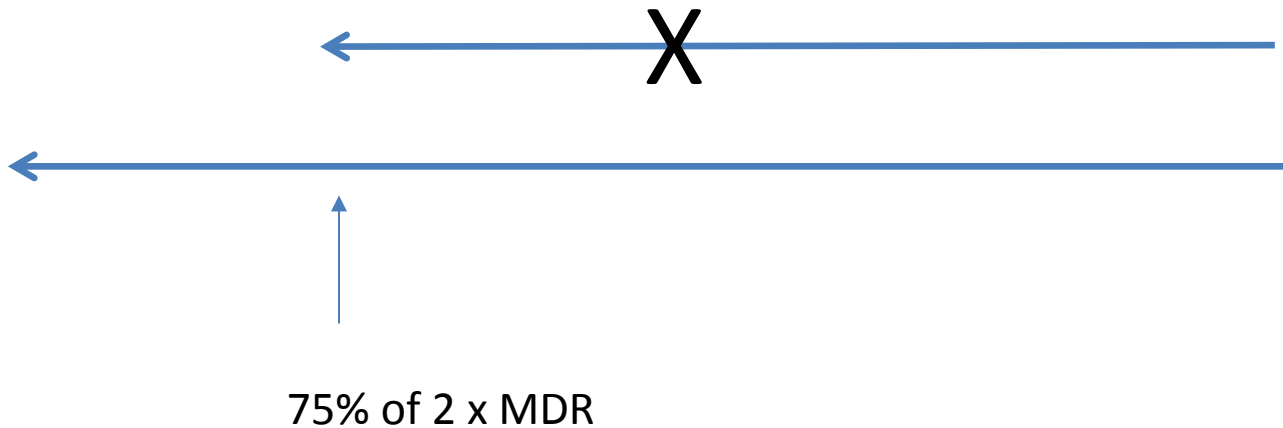
- YES!
- Detection Experiments allowed calibration of the Visual Range estimates of ESW.

Maximum Detection Range (MDR)



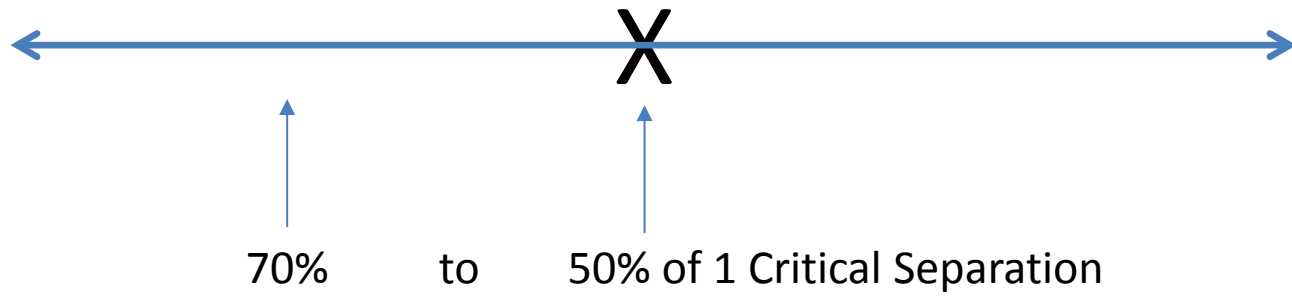
Average of Many = Avg. Max Detection Range (AMDR)

Estimating ESW with 1.5 AMDR



New AMDR to ESW Conversion factors 1.8x, 1.6x, 1.1x
NOTE: 1 AMDR is equivalent to 50% CS!

Estimating ESW with CS



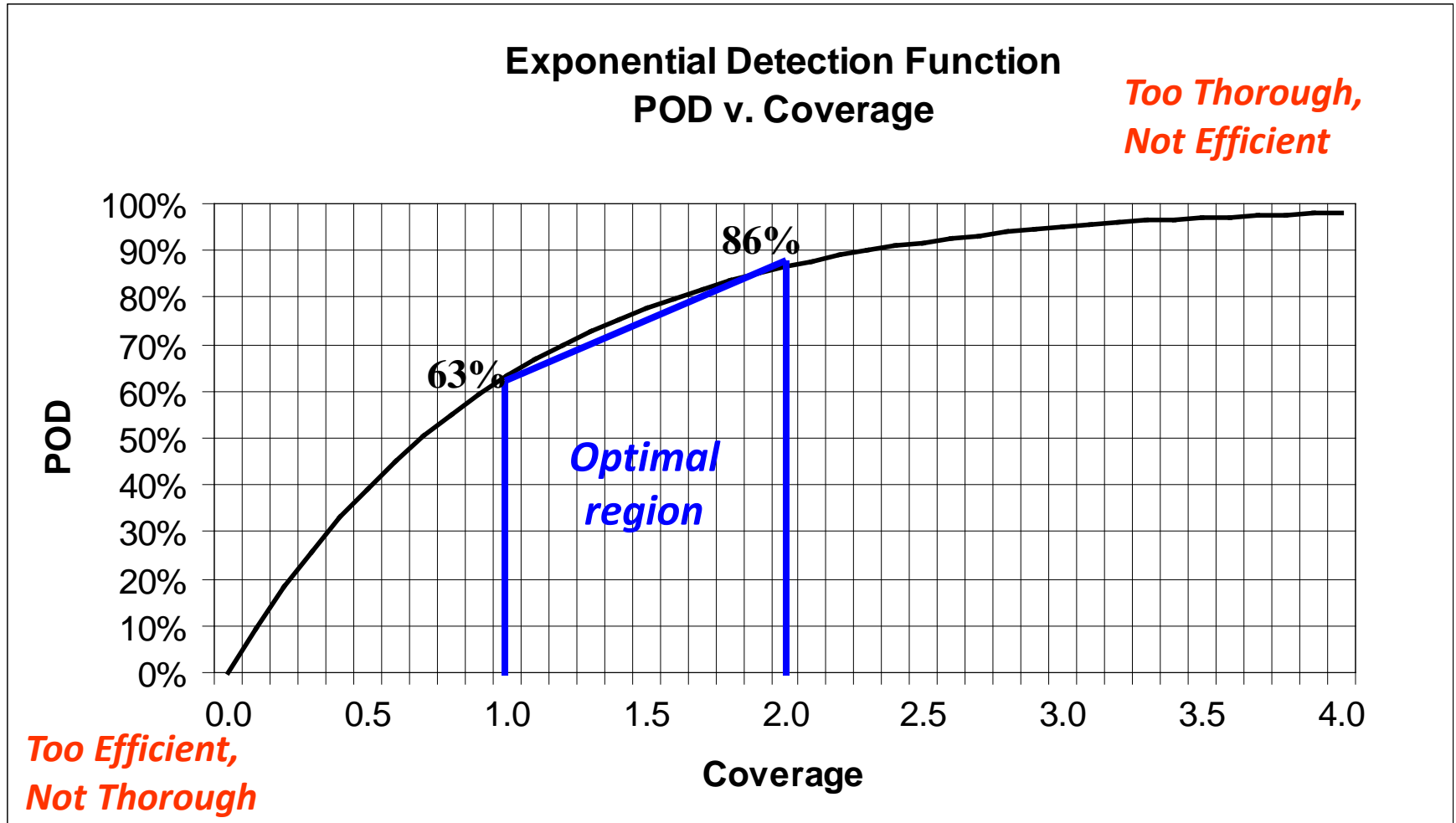
K9 POD scaled to Coverage

- Hatch Graham POD charts went up to 99%
- Tempered in MLPI 2nd Ed., PODmax = 86%
- For SAR Managers, POD scaled to Coverage for conservative estimates
- Some Push Back from Handlers because K9 POD not empirically derived from EDF curve

Adapted From NASAR MLPI Text, 2nd Edition (2007)

Factor	POOR	FAIR	GOOD
Sun Angle	High	Medium	Low/No
Wind	Less Than 4 mph	4 to 10 mph	11 to 20 mph
Cloud Cover	Clear	50% Low Clouds	Overcast or Night
K9 Track Spacing	Estimated Coverage	Estimated Coverage	Estimated Coverage
100m	0.1	0.3	0.5
50m	0.2	0.6	1.0
25m	0.4	1.2	2.0

The “Expanded” EDF



Conclusions

- MSAR-like experiments abandoned for ISAR
- ISAR gets a Detection Function
- Everybody is Happy! (no email flurries)

References

[Wilderness Environ Med.](#) 2014 Jun;25(2):132-42. doi: 10.1016/j.wem.2013.09.016.
Epub 2014 Jan 22.

Use of the visual range of detection to estimate effective sweep width for land search and rescue based on 10 detection experiments in north america.

[Koester RJ](#)¹, [Chiacchia KB](#)², [Twardy CR](#)³, [Cooper DC](#)⁴, [Frost JR](#)⁵, [Robe RQ](#)⁶.

Abstract

OBJECTIVE:

Standard-of-practice search management requires that the probability of detection (POD) be determined for each search resource after a task. To calculate the POD, a detection index (W) is obtained by field experiments. ***Because of the complexities of the land environment, search planners need a way to estimate the value of W without conducting formal experiments.*** We demonstrate a robust empirical correlation between detection range (Rd) and W, and argue that Rd may reliably be used as a quick field estimate for W.