

A Tactical View of Information Technology Needs for Hurricane Response

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i S S R T



View of Murphy from VTOL at Pearlington, MS, Hurricane Katrina., 8/31/06

Outline & Key Points

- First 24 hours in the field is most critical, with first 12 hours as a black hole
- Emerging remote presence information technologies can help fill this black hole, but increase need for fundamental research in information as a whole
- Unmanned aerial systems at Pearlington, MS for Hurricane Katrina illustrates IT problems
- Fundamental- but not traditional- research needed: *remote presence, fusion, dynamic adaptation, feedback to training*



Timeline of a Hurricane

Pre-event



First Responders Bear Initial Brunt

Pre-event

Estb.
IC
(12)



First responders acting independently until incident command established

Emergency Responders Take Over ~12H

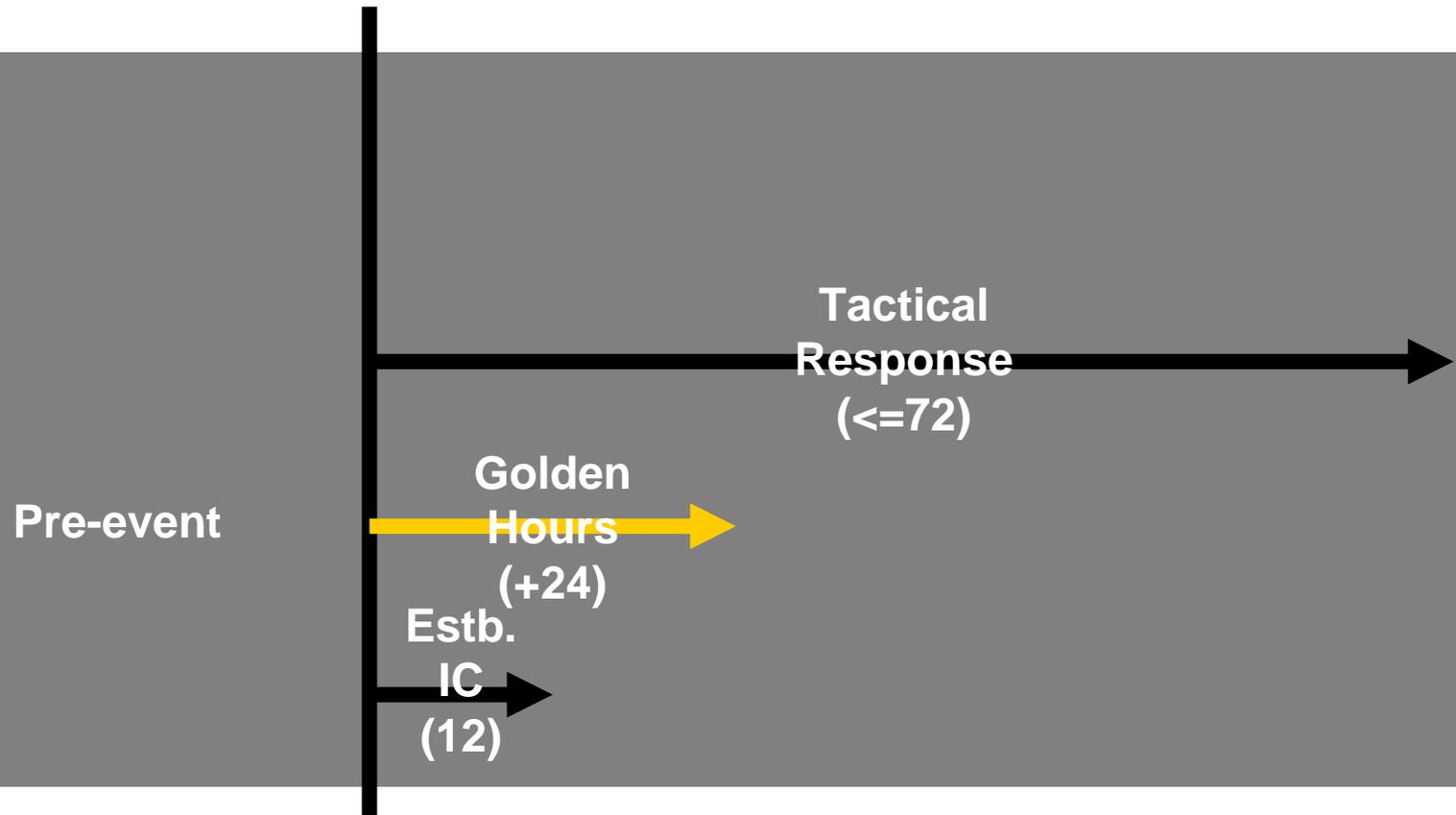
Pre-event

Estb.
IC
(12)

Tactical
Response
(≤ 72)

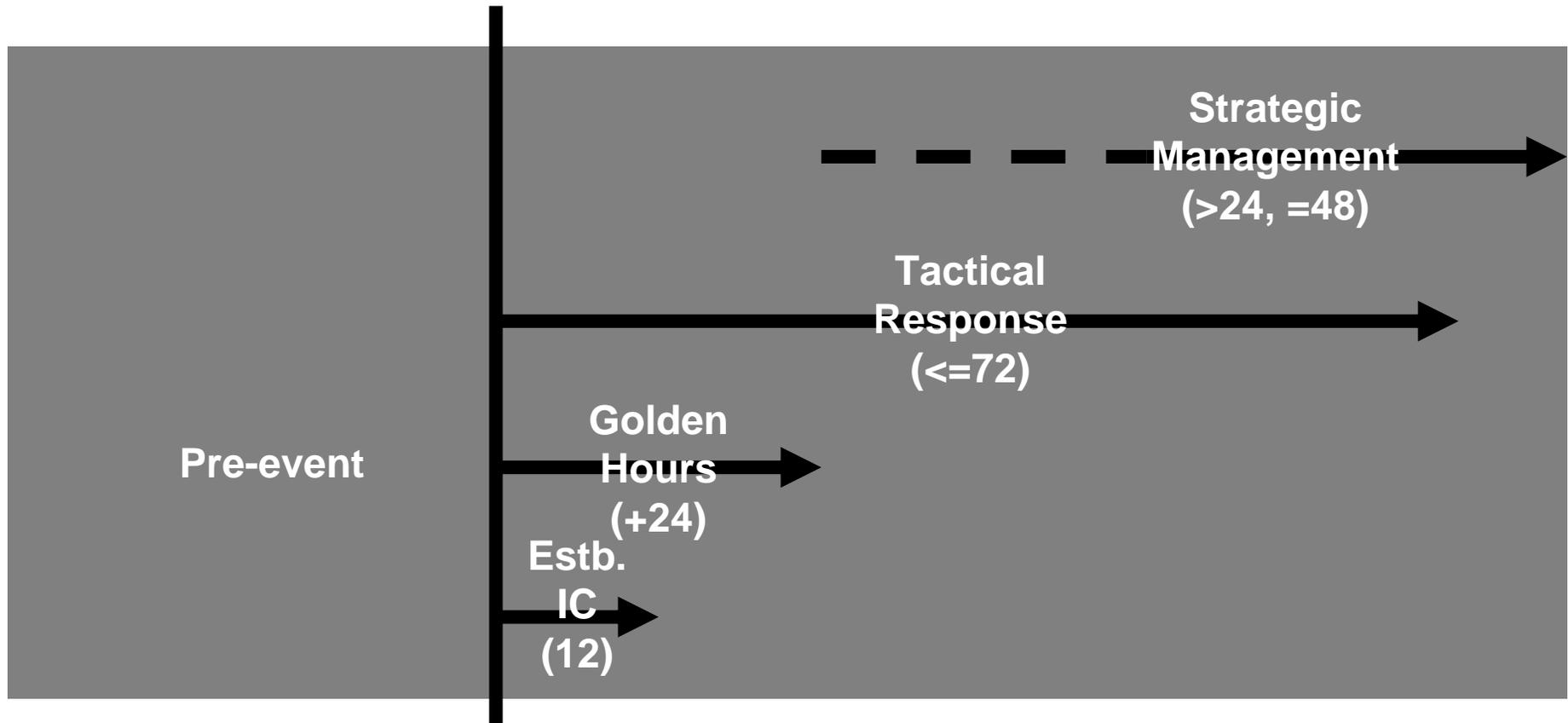
Emergency responders assume control, but collection of highly autonomous, loosely coordinated agencies divided and distributed into teams with little/no communications.

The First 24 Hours Set the Stage



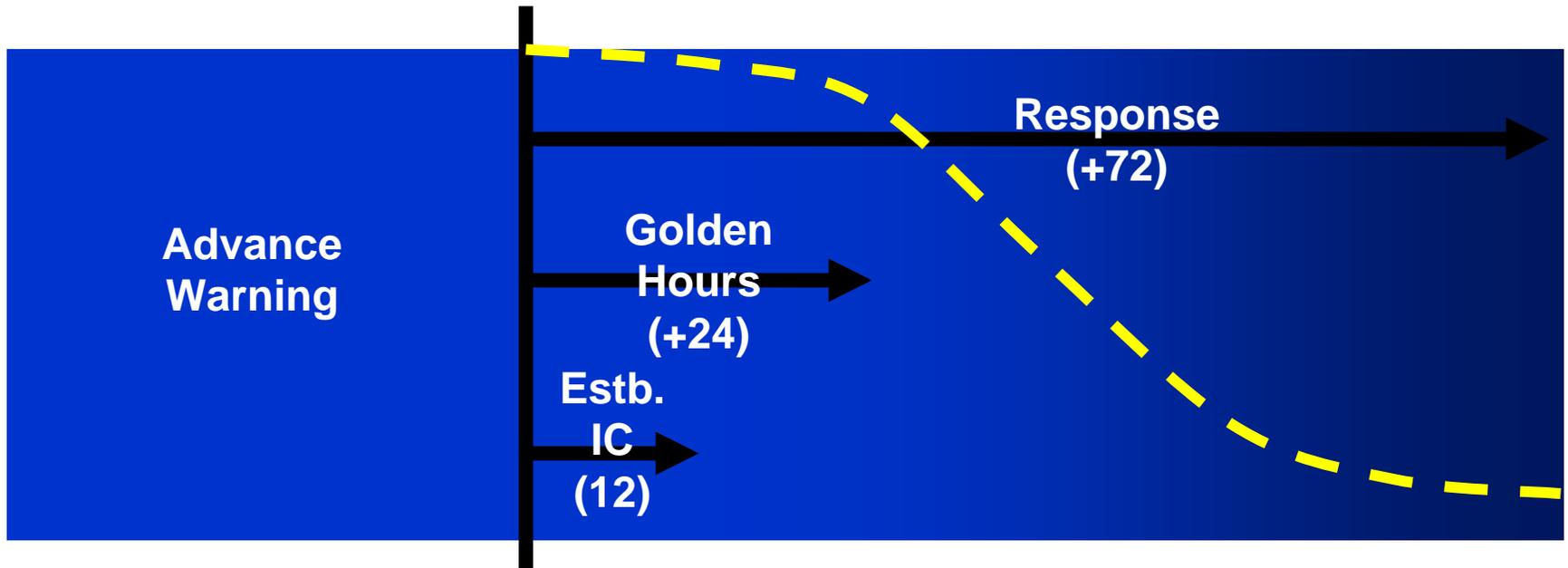
At 24 hour mark, most deployment decisions are irreversible.

Management Activities Come Later



Management functions are put in place in parallel with tactical response, communications intensive with “external” world

Yellow Curve: Impact of Information on Outcome (brighter=more useful)

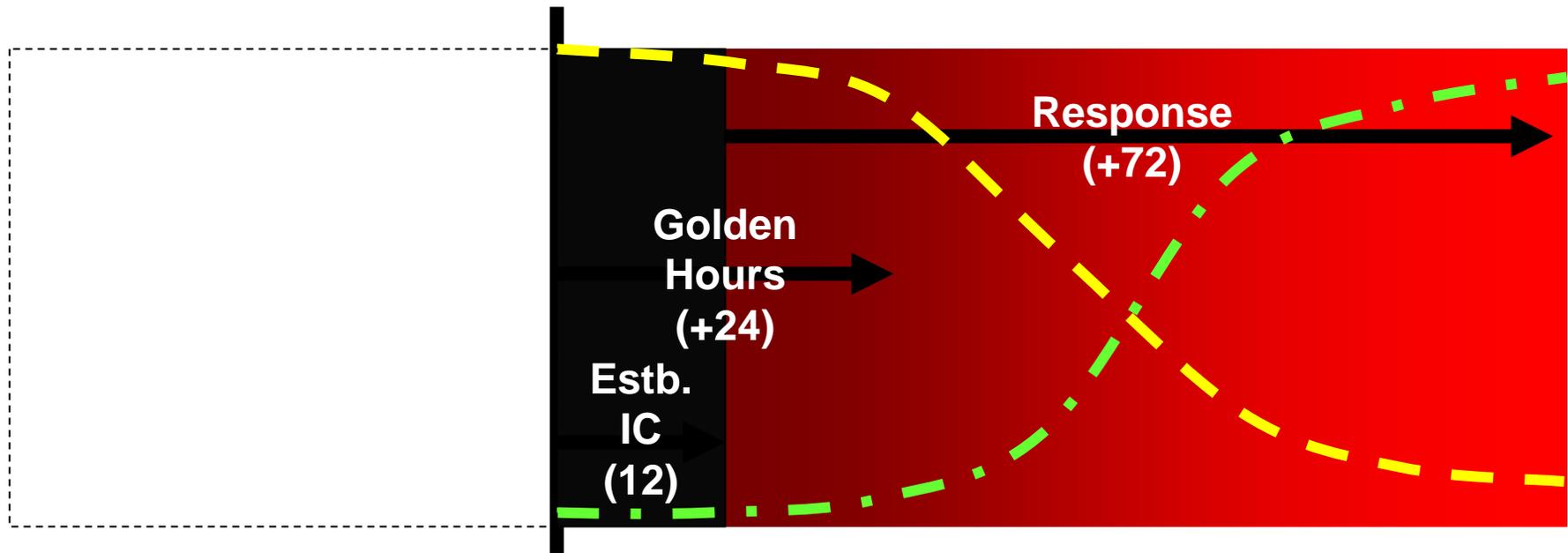


Why decreasing value of information?

- Before: Can acquire, pre-position, deploy, re-deploy resources- optimally, cost-effectively
- After: Medical golden hours are passing
- After: Harder to move resources, make a difference as time goes on (ex. Dennis)

Green Curve: Information Availability

(brighter=more available, accurate)

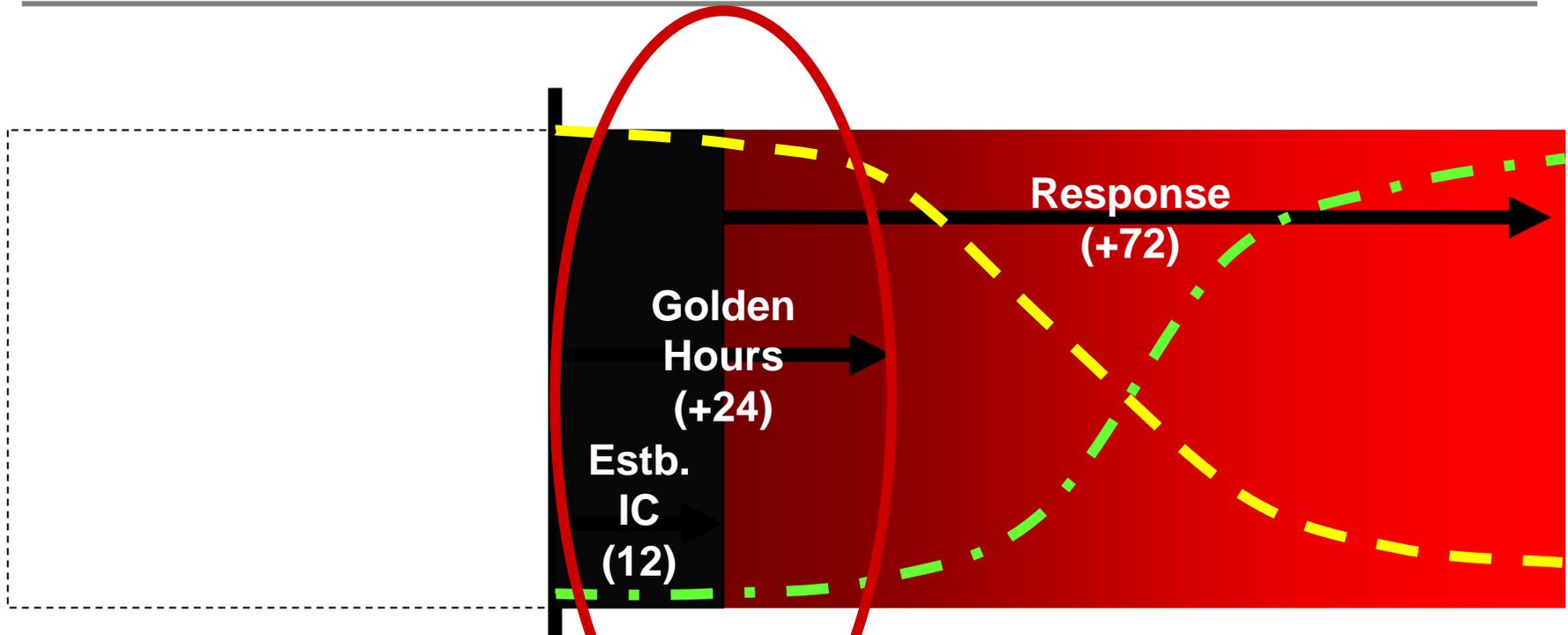


Why black hole in availability?

- Disasters almost always interfere with local communications infrastructure
- Responders are mobile, operating under damaged infrastructure and unfavorable weather conditions
- Uncertainty in data provided by civilians or local agencies requires verification
- Keyhole effects interfere with true situation awareness



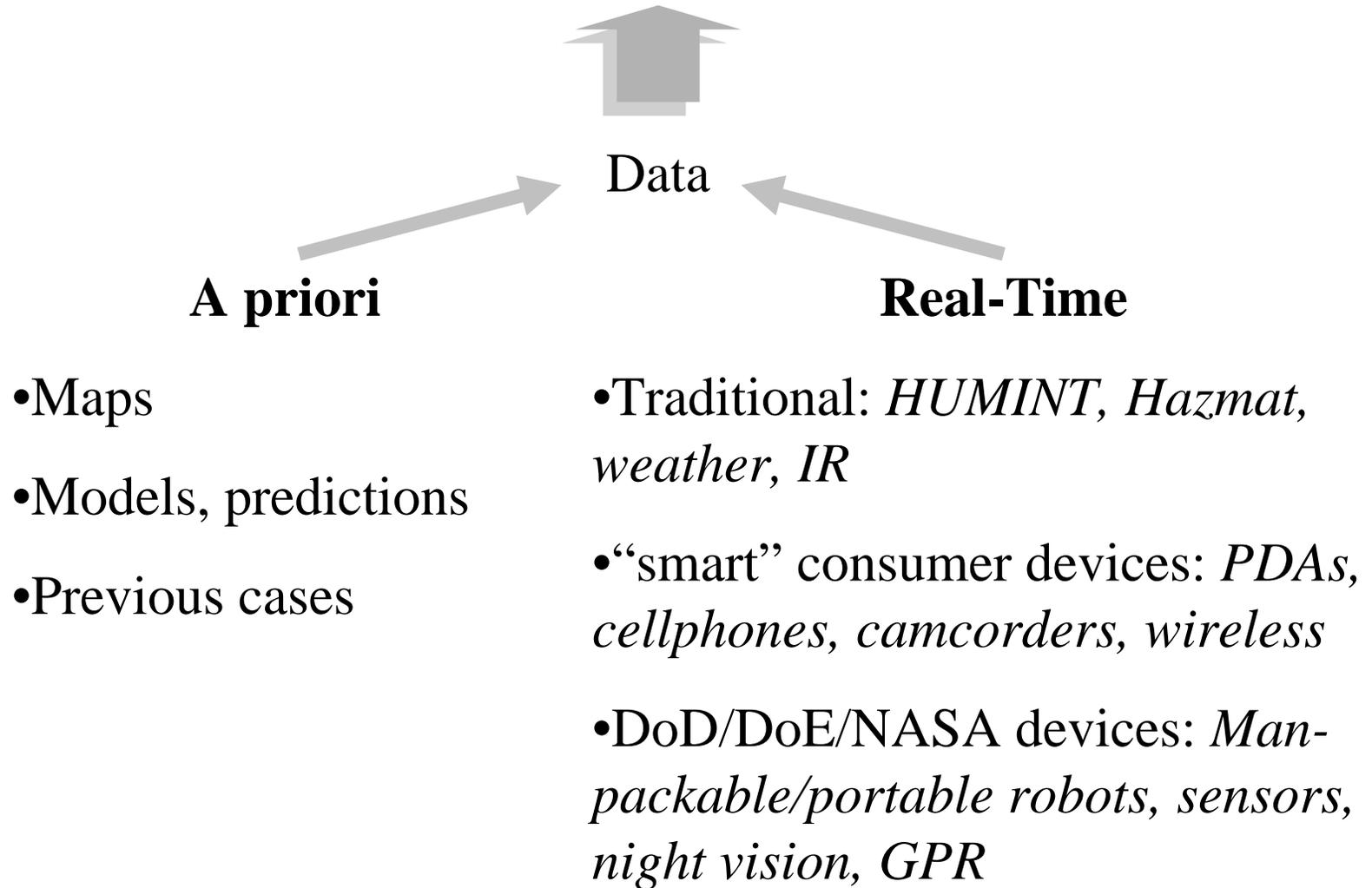
First 24 Hours: Black Hole of Information



How can IT be predeployed or re-established?

How can ALL sources be appropriately empowered?

Sources of Data to Fill in Black Hole



Where do Remote Presence Technologies Come In?

Human physically-situated:

People carry these and provide on-the-spot conversion to information, knowledge

Device physically-situated:
*remote from humans, often serve as **presence**/surrogate for human to actively explore*

Real-Time

- Traditional: *HUMINT, Hazmat, weather, IR, canines*
- “smart” consumer devices: *PDA's, cellphones, camcorders, wireless-enabled**
- DoD/DoE/NASA devices: *Man-packable/portable robots, sensors, night vision, GPR*

Why *Man-Portable* RPIT?

- Same reasons as Iraq
 - Tactical ownership providing immediate information
 - Can deploy in harm's way
 - Programmed to be ever vigilant, “better than bio”



Hurricane Dennis, Crestview staging area FLTF-3

VS.



Post Hurricane Katrina, Biloxi, MS CRASAR

Use During 2005 Hurricane Season

- **Katrina**

- AERIAL

- *Hancock County, MS; CRASAR/FL SERT*
 - *New Orleans; L3/Rep. Kurt Weldon, 82nd Airborne*

- GROUND

- *Biloxi; FLTF-3*



- **Rita**

- AERIAL

- *Florida Keys; Florida Army National Guard*
 - *Louisiana; LA Army National Guard(?)*



- **Wilma**

- AERIAL, SURFACE

- *Marco Island; CRASAR/MIYC*

Example: Pearlington, MS

- Stennis Space Center Forward Staging Area received reports:
 - Stranded people on rooftops
 - Not accessible by ground vehicles
 - 6 miles inland from Gulf
- Projected
 - GIS: additional problems due to cresting of Pearl River

Pearlington, MS



- Small UAV used (6 mile radius)

Pearlington, MS



- Area access still denied but local county crews clearing houses out of road and could see “short cuts”

Pearlington, MS



- No one was still stranded

Pearlington, MS



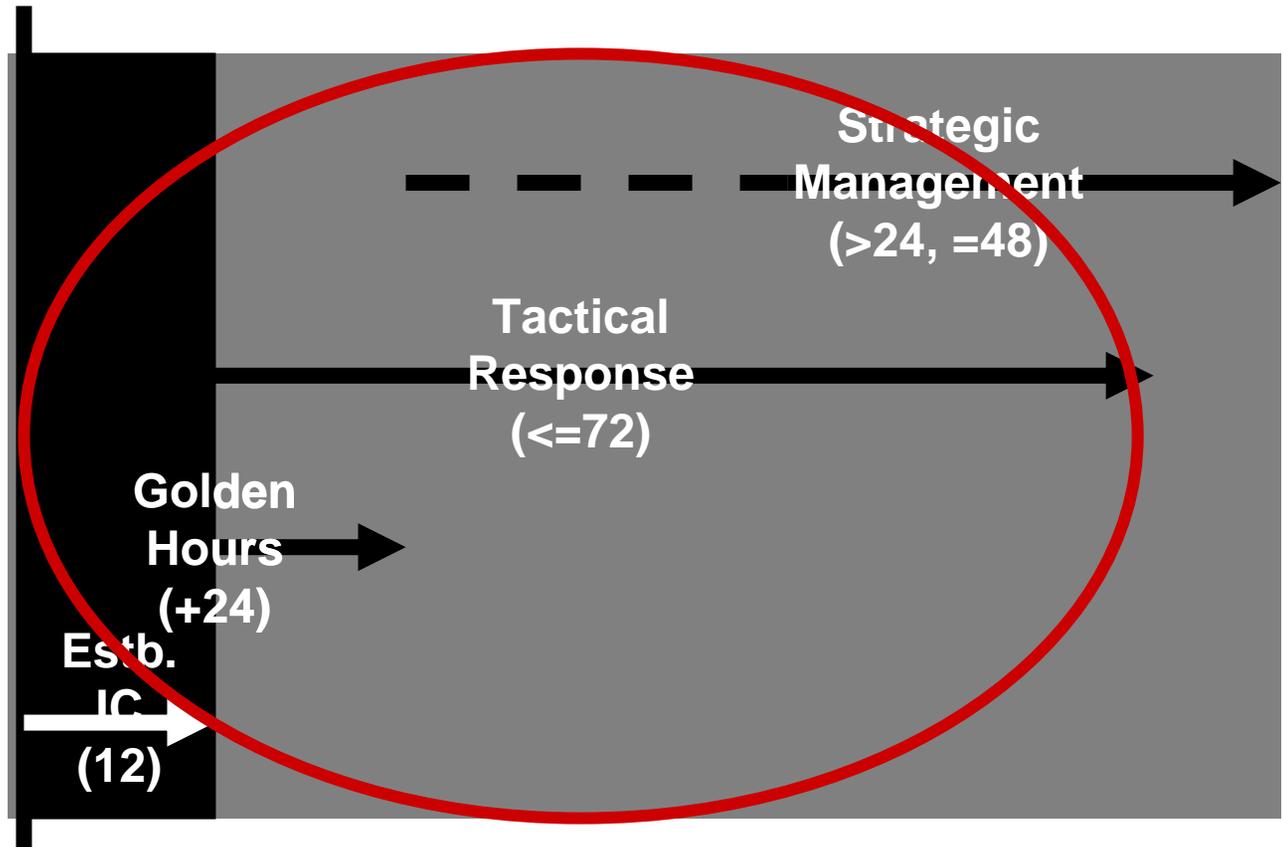
- Pearl River showed no sign of cresting

But RPIT is Not a Silver Bullet

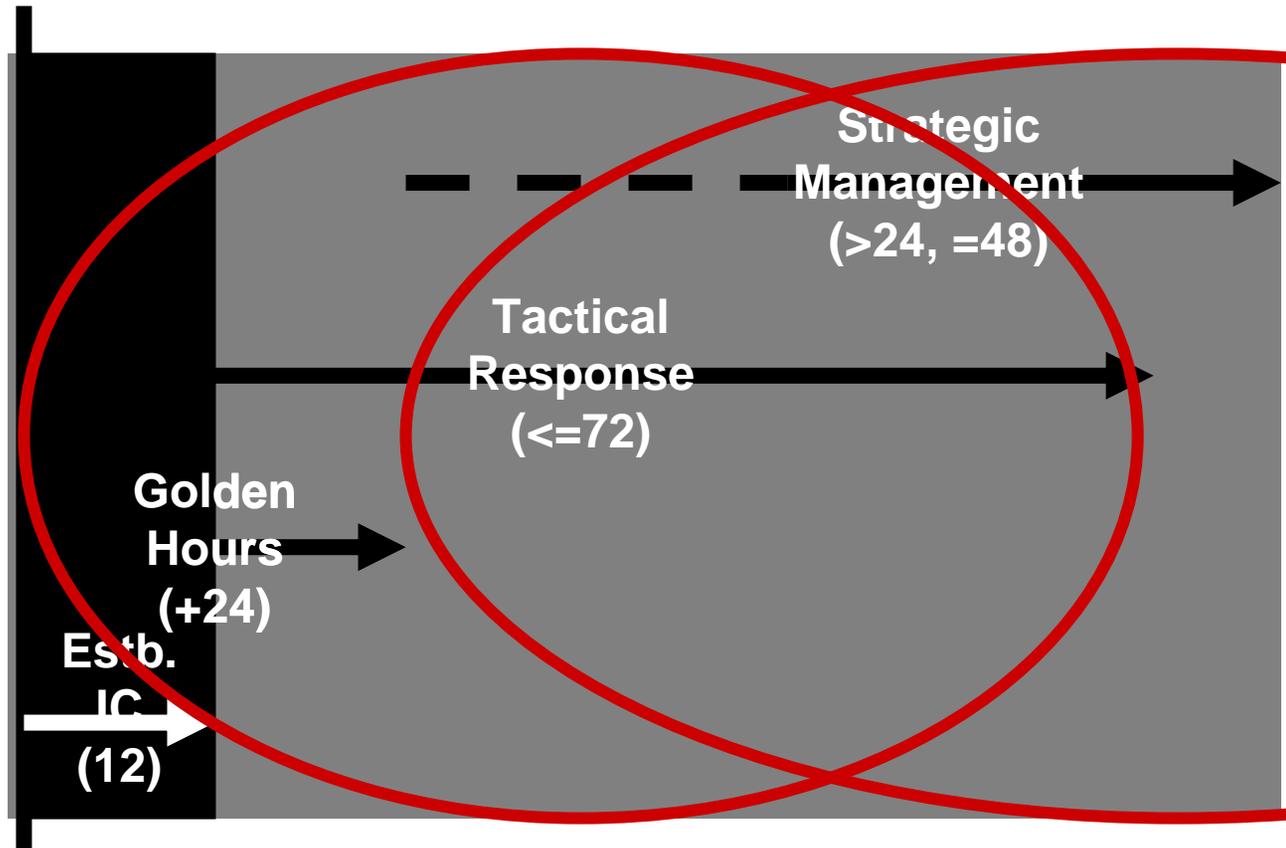
- **Very difficult to build and maintain situation awareness (SA) because mediated presence**
 - Can now see the forest but may miss some of the trees
- **May distract responders or take up their time learning to use or direct**
 - Are an active resource, not passive, for multiple “consumers”
- **Increase demand on IT infrastructure**
 - especially due to need for video, support multiple consumers

Lesson: Tactical Data Remains with the Source

How can distributed responders quickly gather and fuse data from other distributed heterogeneous, asynchronous sources within an imperfect communications infrastructure?



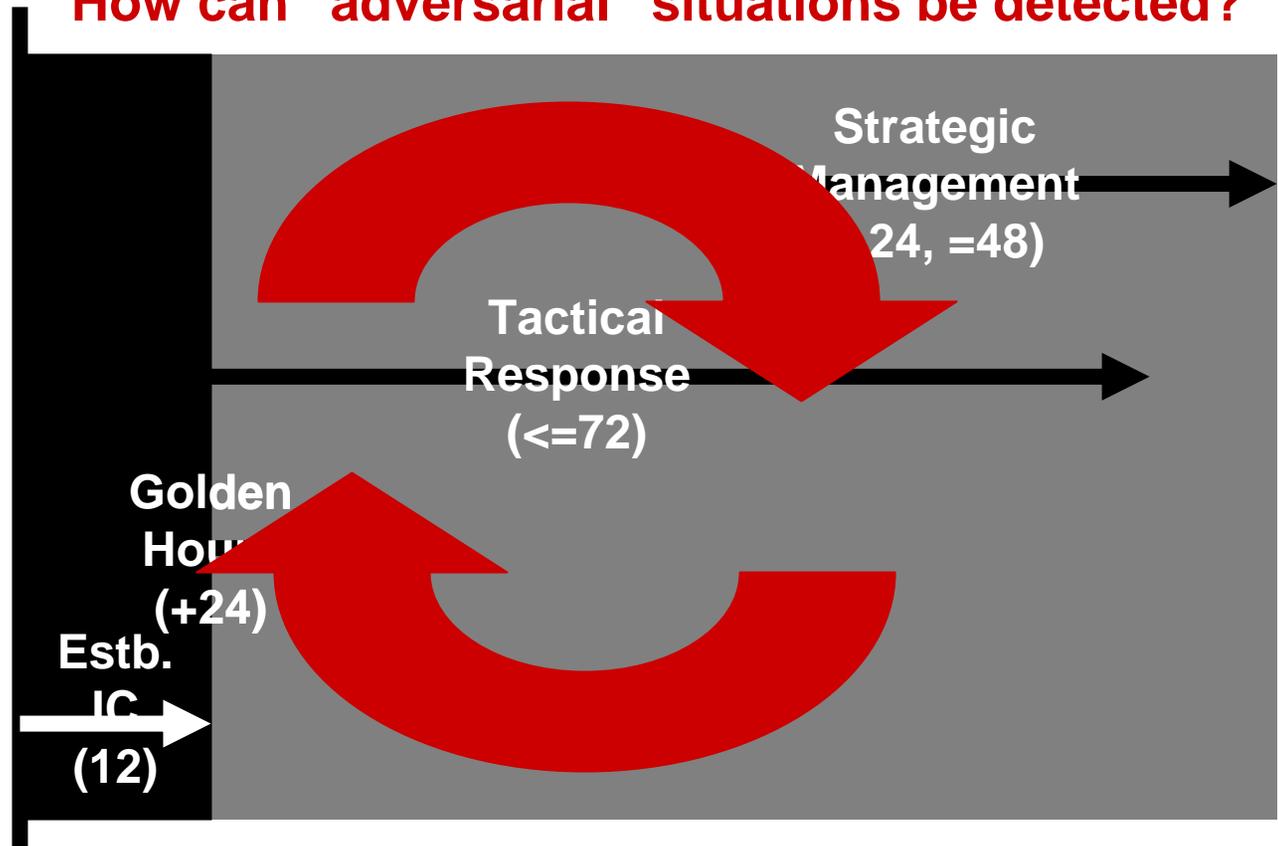
Lesson: Strategic Managers May Not See Data



How to convert indirect tactical data into strategic information?

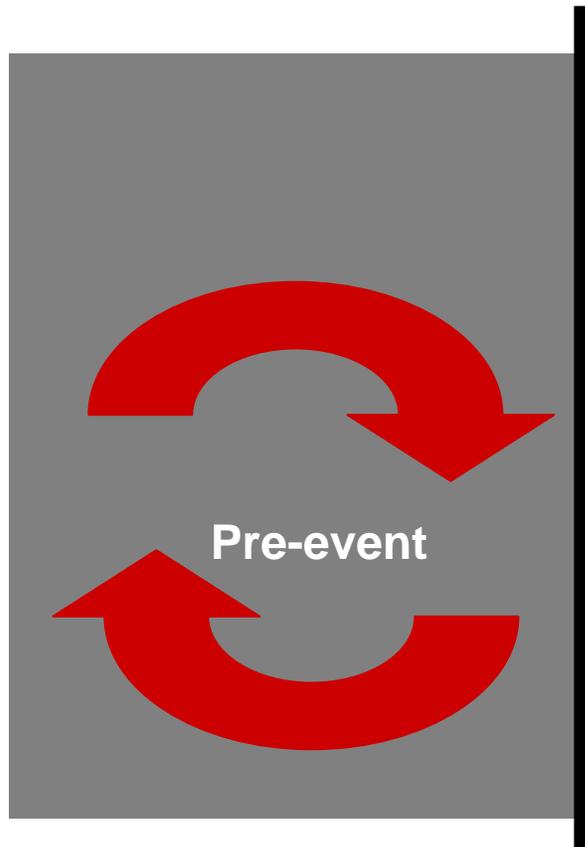
Lesson: No Dynamic Adaptation of Models, Decision Aids, or Data Collection Strategy

How can “adversarial” situations be detected?



How to dynamically change models, decision aids, data gathering and downstream activities as new knowledge becomes available?

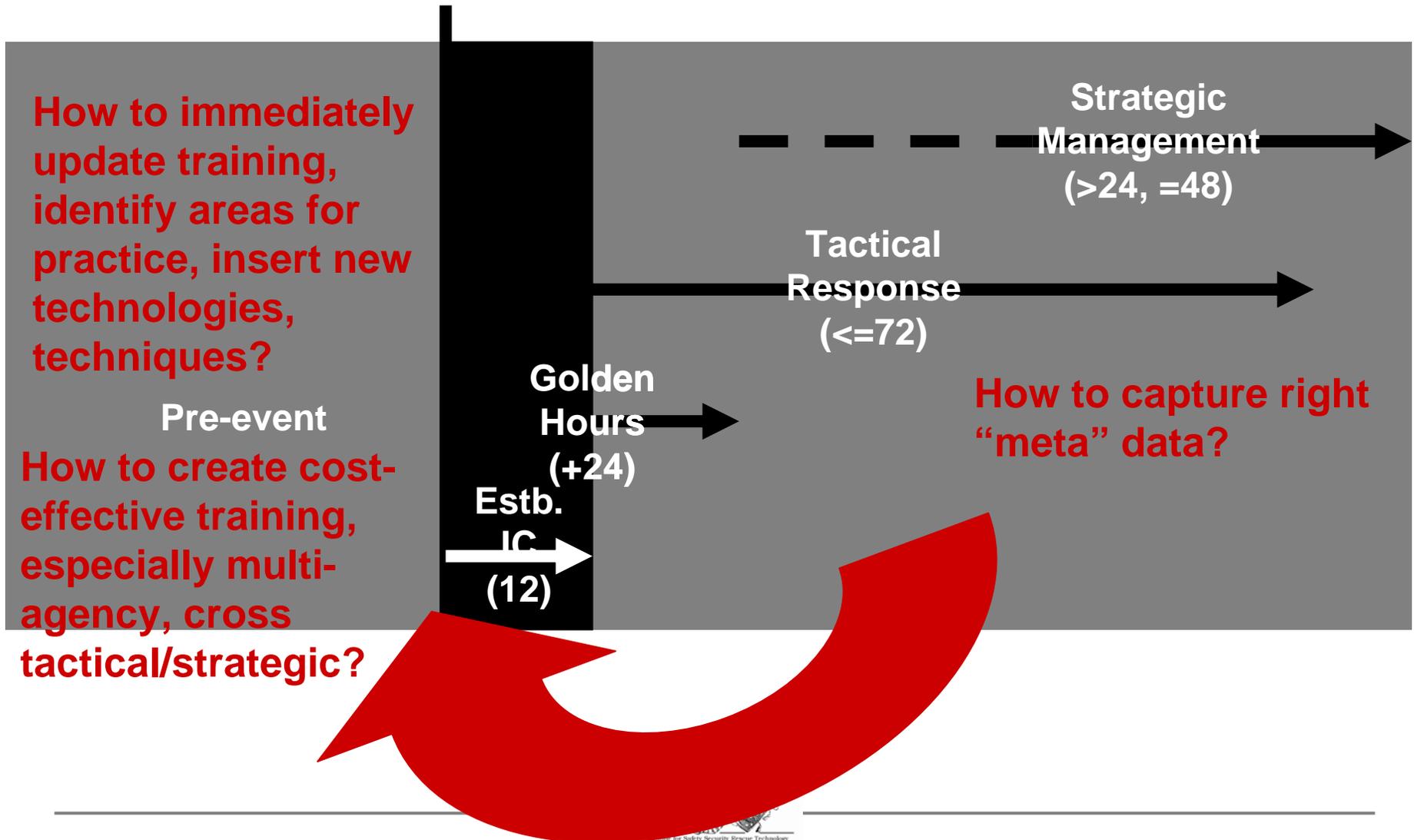
Other notes: Dynamic Adaptation is also needed to Exploit Pre-Event Time



How to exploit wait time for specialized training, preparation?

How to predeploy assets, including IT?

Other Notes: Feedback to Improve Preparedness and Prevention, esp. Training



Summary:

Fundamental Research Areas

- **Remote or computer-mediated presence:** How can these new technologies be effectively used? How can they be inserted without disruption?
- **Fusion:** How can the *local, task-oriented knowledge* from tactical responders, civilians in Hot Zone be coordinated and converted to *information* and propagated to other tactical responders and strategic managers for formation of *situation awareness*?
- **Dynamic adaptation:** How can surprises and new knowledge be detected and immediately inserted into models and decision aids?
- **Feedback for Preparedness/Prevention:** How can new knowledge immediately update training for the Next One?

No longer a widget, but a multi-disciplinary system research

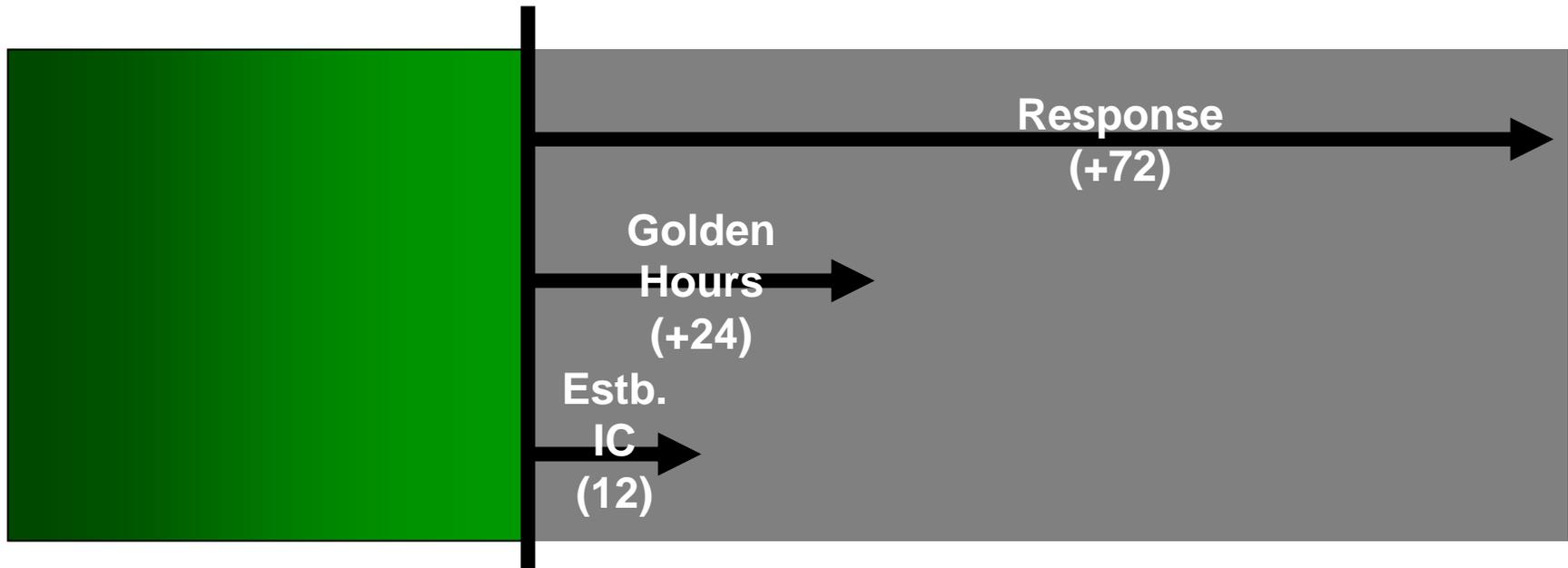


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Long Planning Horizons Don't Necessarily Help (brighter=more activity)



Why is planning better later?

- Final planning requires resources that do not get permission for funding until governor signs act
- Planning is projected for the best available projections
- Regardless, key players don't assemble until day or two before the hurricane