



# Situation Awareness and Decision Making in a Warning Environment

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Advanced Warning Operations Course

IC Core 2

Warning Decision Training Branch



Welcome to IC Core 2, Situation Awareness and Decision Making in a Warning Environment!

# Overview

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- Lesson 1: The Warning Process and the Role of Intuition
- Lesson 2: Individual Situation Awareness (SA)
- Lesson 3: Team Situation Awareness (SA)
- Lesson 4: SA Demons: The Enemies of Situation Awareness
- Lesson 5: Maintaining SA by Managing the Unexpected

Situation Awareness and Decision Making in a Warning Environment is divided into 5 lessons, each of which is a separate on-line module. There is one exam for all 5 lessons of IC Core 2.

# Learning Objectives



1. Identify conditions favoring analytical and intuitive decision making styles.
2. Identify definitions, examples and failures of the three levels of Situation Awareness (SA).
3. Identify factors that can impact getting and maintaining individual SA.
4. Identify factors that can impact getting and maintaining team SA.
5. Identify the SA demons and how they can inhibit SA.

Here are the Learning Objectives for IC Core 2. The objectives that apply to each lesson will be repeated at the beginning of each lesson. The Learning Objectives will be tested when you take the on-line exam for IC Core 2.

# Learning Objectives



6. Identify the two practices that can help facilitate a prompt response to unexpected events.
7. Identify the attributes of the operating environment of a Highly Reliable Organization.
8. Identify the 5 characteristics of a Highly Reliable Organization.
9. State the impact of overconfidence on responding to the unexpected.

Here are the remaining Learning Objectives for IC Core 2. The objectives that apply to each lesson will be repeated at the beginning of each lesson and will be tested using a single on-line exam for IC Core 2.

# Performance Objectives



1. Using specific data examples, identify the three levels of SA and how they are contributing to your warning decisions, while working:
  - a) WES simulations, and
  - b) Warning events.
2. As part of post-event analysis, determine the role that SA (good or bad) at the three levels played in the warning decisions that were made.

The Performance Objectives for IC Core 2 apply during this course as well as after completion. Though they are not tested formally, questions related to these Performance Objectives will be posed during the course simulations.



# Situation Awareness and Decision Making in a Warning Environment

Advanced Warning Operations Course  
IC Core 2

Lesson 1: The Warning Process and  
the Role of Intuition



Warning Decision Training Branch

Lesson 1 will focus on the elements of the Warning Process, which includes both meteorological and non-meteorological factors. There is also a section on analytical and intuitive decision making, and the role of intuition in the warning “domain”.

# Lesson 1: The Warning Process and the Role of Intuition

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Learning Objective:

- Identify conditions favoring analytical and intuitive decision making styles.

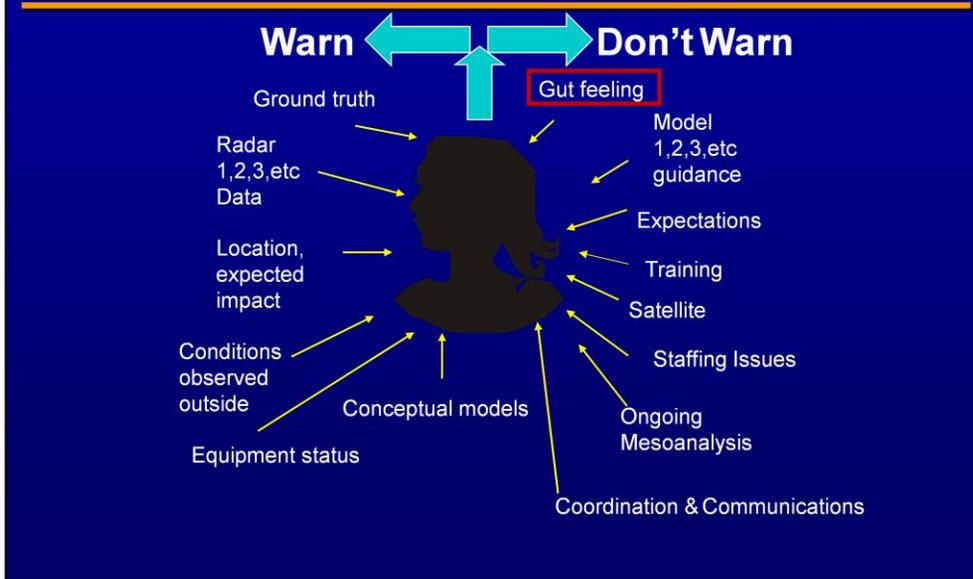
“We dance round in a ring and suppose, but  
the secret sits in the middle and knows.”

Robert Frost

Lesson 1: The Warning Process

The Learning Objective associated with this lesson addresses analytical and intuitive decision making.

# Information Processing in a Warning Environment



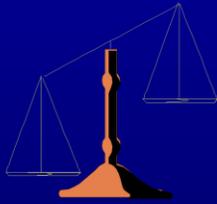
There are so many different types of information that must be processed to make a warning decision. Using each of these data sources effectively is difficult, since the strengths and limitations of each data set must be well understood. Also, the update times of the various data sources vary, which requires mental tracking.

This lesson will take a particular look at the contribution of “gut feeling”, which is your intuition.

# Decision to Warn

## The Sum of All Inputs

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**Beyond a reasonable doubt –  
Very likely (Criminal Trial)**

**A preferred, but rare, level of  
confidence in warning decisions**



**Preponderance - More  
likely than not (Civil Trial)**

**Typical level of confidence  
in warning decisions**

“Beyond a reasonable doubt” is a level of certainty that is very rare in warning decisions. We would like to operate at that level, but most often, a warning is issued because the “preponderance of the evidence” supports it. If you find yourself delaying making a warning decision by waiting for a higher level of certainty, think about this concept. Perhaps you are waiting for a level of certainty that is not going to exist.

# The Warning Process

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- Anticipation
  - If you are not looking for it, will you see it when it's there?
- Product Selection
- Feature Recognition
- Spotter Reports
- Warning Generation/Dissemination
- Non-Meteorological Factors

Among these elements of the warning process, we will first focus on Anticipation. Anticipation is based on your threat assessment, which is hopefully an ongoing process. Threat assessment and monitoring the mesoscale environment creates your expectations. Those expectations affect the data cues that you will be looking for. An example would be an expectation of large hail leading you to look for hail spikes in the radar base data.

## Before You See Radar Data...



This animation depicts the “tipping of the scales” of a warning decision before looking at radar data. The climatology, synoptic, and mesoscale factors all affect the warning decision. In this case, the scales are moderately tipped in favor of a warning. You can replay the movie if you wish.

## Before You See Radar Data...



This animation depicts a different “tipping of the scales” of a warning decision, where the scales are strongly tipped in favor of a warning. Consider looking at the same radar data given the conditions of the previous slide vs. the conditions of this slide. How might your expectations impact your decision to warn? Or impact how intensely you may interrogate radar data looking for signatures?

# The Warning Process

- Anticipation
- Product Selection
- Feature Recognition
  - Aha! The intuitive response
- Spotter Reports
- Warning Generation/Dissemination
- Non-Meteorological Factors



There are many challenges here: choosing products appropriate for the anticipated threat, recognizing a significant feature when you see it, knowing which spotter reports to rely on, and conveying the threat through language in products issued. Then there are numerous factors that have nothing to do with meteorology...

# Non-Meteorological Factors

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- The complex “domain” of the forecast office
  - Staffing experience, availability, workload, stress, fatigue...
  - Volume of calls
    - Incoming and outgoing
  - Equipment problems
  - Concerns/pressure about office performance
  - Communication and coordination



Your work environment is known as a “domain” by those who study decision making. The WFO domain is a particularly complex one, especially during a warning event. There are things that can be done to mitigate some of the potential chaos, which will be presented later in Core 2 and in other parts of the AWOC Core track.

# Cognitive Load

## A Limited Resource



- Warning forecaster's processing involves...
  - Attention and working memory (short term)
    - Conscious activities
  - Long term memory and intuition
    - May be conscious or sub-conscious
- *Your intuitive response (gut feeling) may be a conscious memory or a feeling*

I've seen this  
before!

Something's  
not right here

The total mental activity for working a task is called cognitive load. This involves cognitive work done at the conscious and sub-conscious level. These concepts will be explored later in IC Core 2. The key thing to remember is that no matter how skilled a human may be, cognitive activities are in total a limited resource. Intuition is an important part of cognitive load and will be discussed in the next few slides. One of the ways to learn to use intuition effectively is to understand that it may be experienced as either a conscious thought or an emotion (gut feeling).

## Decision Making Involves both Intuition and Analysis

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- Some conditions more favorable for analytical vs. intuitive decision making
- Use intuition to buy a car?
  - Hope not!



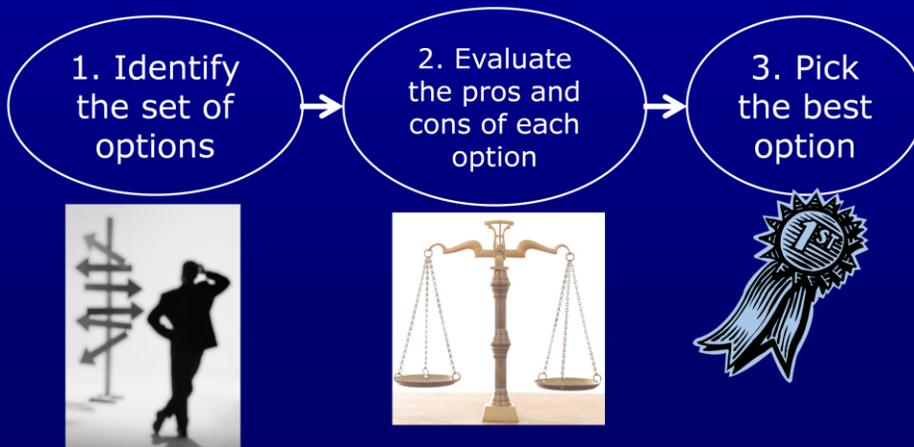
- Do a thorough analysis of options before leaving a burning building?
  - Hope not!



Our decisions are always processed with some combination of analysis and intuition....this is not an either/or relationship. Some environments are more favorable to the different decision making approaches. For examples, buying a car is (hopefully) going to be largely an analytical decision, while deciding to get out of a burning building is (hopefully) largely an intuitive decision.

# Analytical Decision Making

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The process of analytical decision making has the following steps. We begin by identifying the available options. Then the pros and cons of each option are evaluated. Based on those pros and cons, the best option is determined.

# Analytical Decision Making

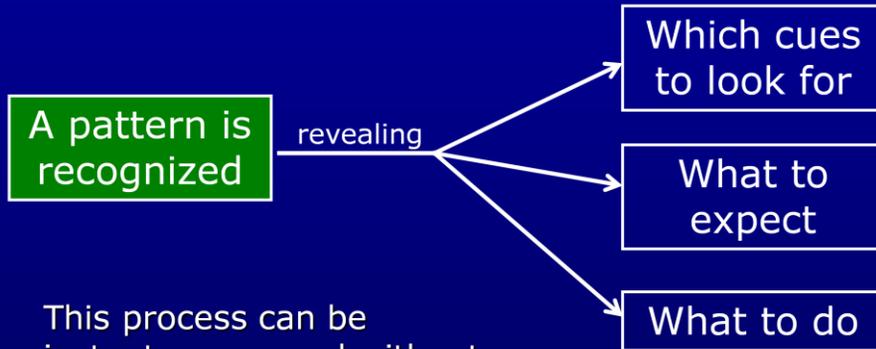
- Favorable Conditions
  - Little time pressure
    - Time to identify multiple options
  - Computational complexity
    - Identify and evaluate pros and cons of each option
  - Thorough analysis
    - Determine the best option



Given the analytical process, the most favorable conditions start with environments that do not have significant time pressure. There is time to identify multiple options. Identifying and evaluating the pros and cons of each option is the next step, which also requires time and computations, sometimes rather complex ones. A thorough analysis process results in finding the best option.

# Intuitive Decision Making

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This process can be instantaneous and without conscious thought

Intuitive decision is usually triggered by pattern recognition of some sort. The data cue that triggers your intuition reveals the next steps to take, such as which additional data to look for, formulating your expectations and how to respond. This process is usually a conscious one. As you gain more expertise, it can also be nearly instantaneous and the next steps occur without conscious thought (at least initially!).

# Intuitive Decision Making

- Favorable Conditions
  - Significant time pressure
  - Dynamic conditions
    - Uncertainty
  - Lives at stake



The favorable conditions for intuitive decision making are much different. There is significant time pressure in these environments. Things are happening quickly and there is a lot of uncertainty...it is a dynamic situation. Frequently, lives are at stake.

# The Role of Intuition

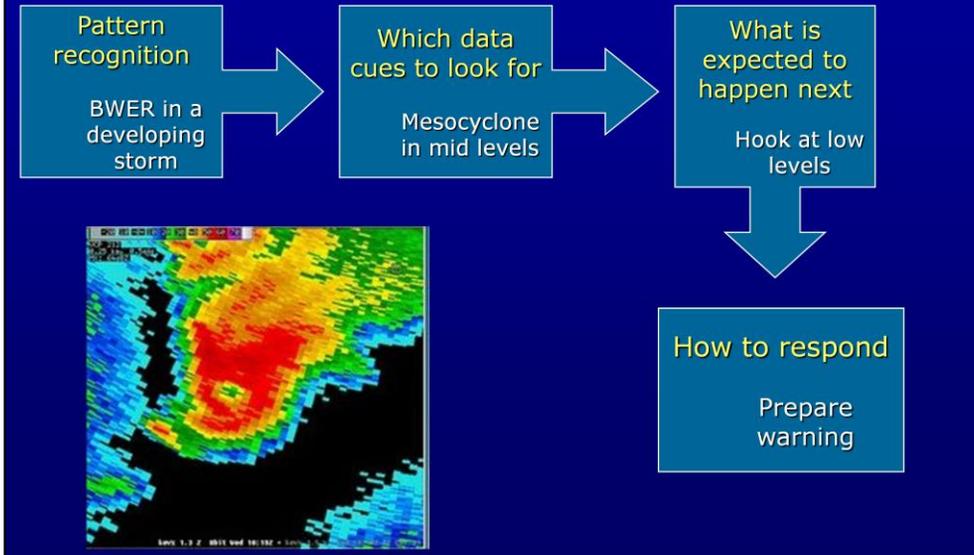
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- “Your intuitions are not accidental. They reflect your experience.” Gary Klein
- Experience ≠ expertise
  - Intuition is the voice of your experience
  - Using it effectively is expertise
- Your intuition responds (a thought or a feeling) to data cues, prompting your next step



Gary Klein is a psychologist who has studied decision makers in their environments. He has written about the importance of the use of intuition among experts in dynamic environments. Intuition comes from experience, but that is not the same as expertise. Intuition is your experience speaking to you, but using it effectively involves expertise. An intuitive response may be a conscious thought or just a feeling. Experts have learned to respect that response and use it as a prompt to take the next step.

# Experts in Dynamic Domains Often Use Their Intuition



The expert warning forecaster has many things in common with experts in other dynamic domains that use both their intuition and their analysis to make decisions. Recognizing a significant pattern can occur consciously (aha! I know what this is and I know what to do) or sub-consciously (a feeling that this is significant). There may be additional data cues to look for and decisions to make. The point here is that the intuitive response can be the beginning of a process that leads to a warning decision.

# The Role of Intuition

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Two different types of intuitive responses:

The data cues *fit* a pattern

“It makes sense”:

- I’ve seen this before
- I know what it means
- I know what to look for
- I know what to do

The data cues *do not fit* a pattern

“It doesn’t make sense”:

- There is something missing here
- Something doesn’t seem right
- Step back and re-evaluate

The “aha” intuitive response happens when the data do fit a known pattern...“it makes sense”. The remaining steps follow quickly. If additional information is needed, you know what you are looking for. You also know what you are going to do.

The other possibility is that the data do not fit a pattern...“it doesn’t make sense”. This often involves stepping back and doing some re-evaluating.

In each case, the expert knows what to do following the intuitive response.

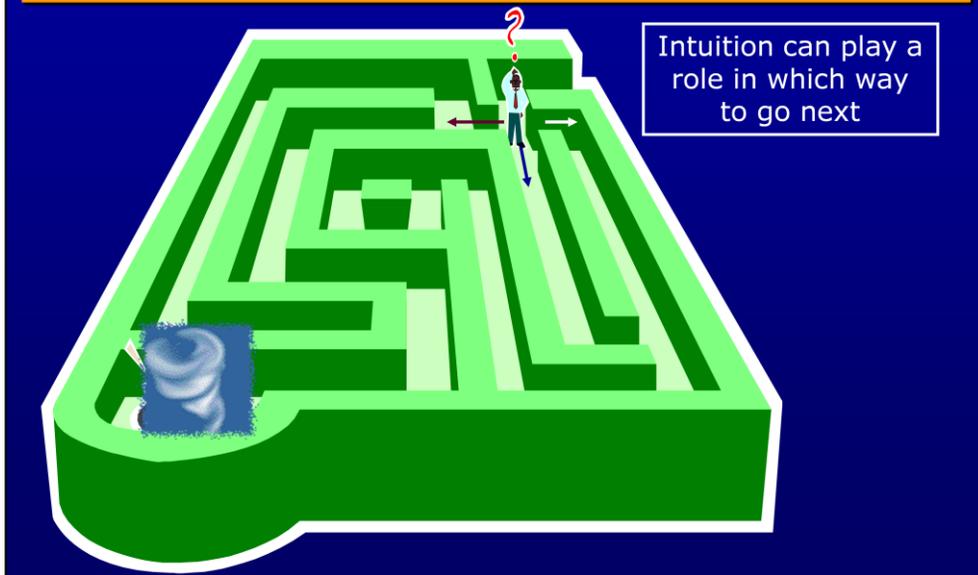
## “It Just Didn’t Look Right”

- TDA detections behind gust front
  - No vertical continuity of rotation in SRM
- Severe Thunderstorm warning; environment not favorable for tornadoes
- Reports of wind damage; cause ambiguous
- Readied Tornado Warning pending better ground truth or more convincing radar signatures
- No tornado; wind damage due to gust front



In this event, the forecaster was concerned about the algorithm detections, but the signatures in the radar base data conflicted with the TDA results and the environment was not favorable for tornadoes. The sense that something wasn't right led him to seek additional data cues and maintain the warning status as Severe Thunderstorm.

# Decision Points



The decision making for a warning event can be represented by a maze. The intuitive response often leads to the next step...with additional data cues to look for or perhaps going directly to issuing a warning. When examining your warning decision making, consider the role of intuition.

"Never ignore a gut feeling,  
but never believe that it is enough."  
Robert Heller



Intuition can be a powerful tool, but it is not the only tool. It is just a part of the process of analyzing the radar base data, assessing the near storm environment and assimilating reports.

The analytical decision making process is best suited to which environment?  
- The goal of choosing the best option among many  
- Several conditions and variables  
- Significant time pressure  
- Low or stable

Quiz - 1 question

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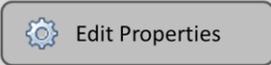
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Lesson 1: The Warning Process and  
the Role of Intuition



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This concludes Lesson 1: The Warning Process and the Role of Intuition.  
There are four remaining lessons for IC Core 2.

## Questions?

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1. Check with your AWOC facilitator (most often the SOO)
2. Send your question to [awoccore\\_list@wdtb.noaa.gov](mailto:awoccore_list@wdtb.noaa.gov)

If you have questions about the material from IC Core 2, first check with your AWOC facilitator (most likely your SOO). If your AWOC facilitator cannot answer your question, please send an email to [awoccore\\_list@wdtb.noaa.gov](mailto:awoccore_list@wdtb.noaa.gov).