



# **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 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

Situation Awareness and Decision Making in a Warning Environment is divided into 4 lessons. Each lesson is a separate presentation and is expected to take an **average** of 30 minutes to complete.

# 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 the entire IC. 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.

# 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. Developing SA in the “domain” of the warning environment is a skill that evolves over time and is an important asset in making sound warning decisions.



# **Situation Awareness and Decision Making in a Warning Environment**

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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.

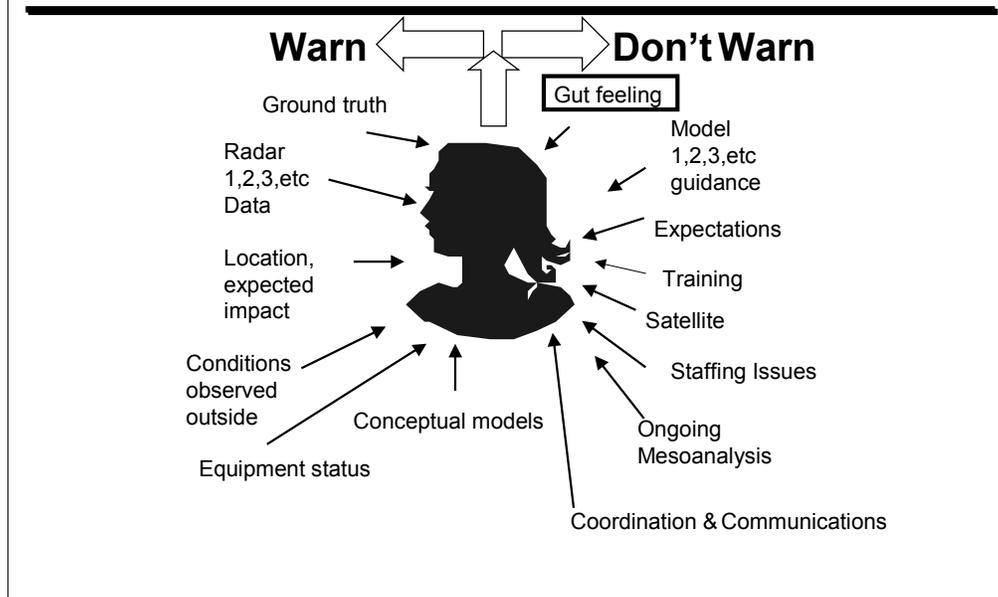
“We dance round in a ring and suppose, but  
the secret sits in the middle and knows.”

Robert Frost

Lesson 1: The Warning Process

The Learning Objective associated with this lesson addresses analytical and intuitive decision making. The Learning Objectives will be tested when you take the on-line exam for IC Core 2.

# Information Processing in a Warning Environment



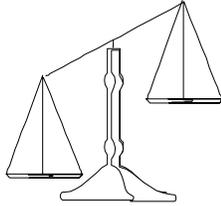
There are so many different types of information that must be blended to make a warning decision. Using each of these data sources effectively is difficult, since the strengths and limitations of each data set must be well understood. Also, the update time scales of each data source differs, which requires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

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

# Decision to Warn

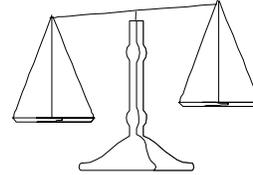
## The Sum of All Inputs

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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**

*Assessing the situation and making a decision  
are two different processes*

“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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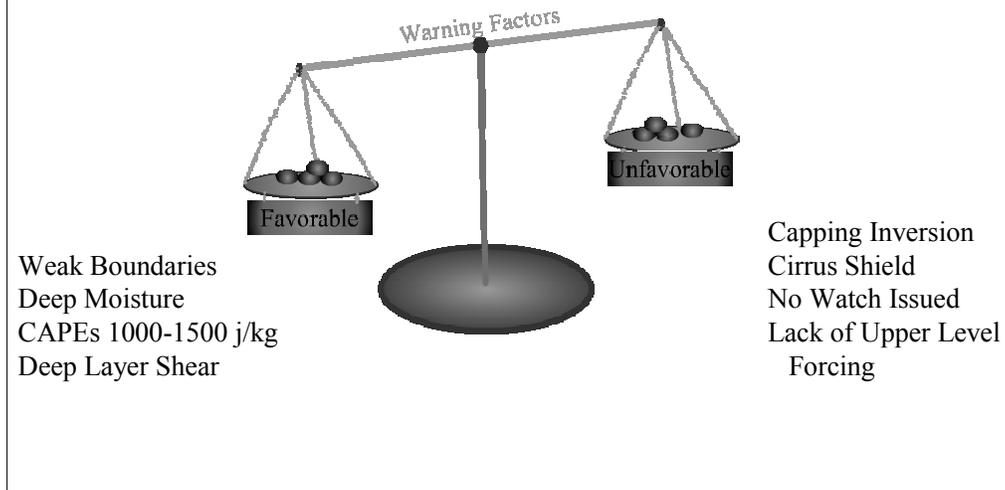


- Anticipation
  - If you are not looking for it, will you see it when it's there?
- Product Selection
- Feature Recognition
- Spotter Reports
- Warning Generation/Dissemination
- Non-Meteorological Factors

Among these elements of the warning process, we will focus on Anticipation and Non-Meteorological Factors. Anticipation is based on Threat Assessment (part of the AWOC Severe Track), which creates expectations with respect to data cues, such as types of radar signatures. Non-meteorological factors involve the “domain” of the forecast office, as well as human decision making characteristics.

## How the Scales are Tipped *Before Looking at Radar Data*

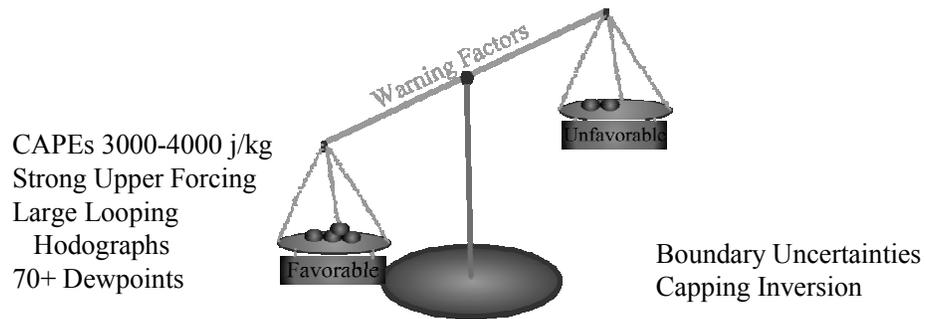
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This animation depicts the “tipping of the scales” of a warning decision before looking at radar data. The climatology, synoptic, and mesoscale factors all affect the warning decision. In this case, the scales are moderately tipped in favor of a warning.

## How the Scales are Tipped *Before Looking at Radar Data*

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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 strongly tipped in favor of a warning.

# The Warning Process

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- Anticipation
- Product Selection
  - A small subset of the 100K + choices
- Feature Recognition
  - Aha! The intuitive response
- Spotter Reports
  - Not all spotter reports are created equal
- Warning Generation/Dissemination
  - Does it go out correctly? Does it get the right response?

**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 of staff
    - Available staff vs. workload
    - Stress, fatigue, pressure
  - Volume of calls (incoming/outgoing)
  - Equipment problems
  - Weather at station (affects number of calls and equipment reliability)
  - Concerns about office performance
  - Communication and coordination



There is an enormous amount of work that goes on during a warning event and usually a number of unknowns. The good news is that there are things that can be done to mitigate some of the potential chaos, which will be presented later in this IC and in other ICs.

# Cognitive Load

## *A Limited Resource*

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- What is going on in that warning forecaster's head?
- Attention and working (short term) memory
  - Conscious activities
- Long term memory and intuition
  - May be conscious or sub-conscious
- *Your intuition (gut feeling) may respond to a data cue as a conscious memory or as a feeling*

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).

# Analytical and Intuitive Decision Making

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- Analytical decision making

- Identify the set of options
- Evaluate the pros and cons of each option
- Pick the best option



- Intuitive decision making

- A pattern is recognized, revealing:
  - Which cues to look for, what to expect and what to do
- This process can be instantaneous and without conscious thought



Most decisions involve a combination of analysis and intuition. Intuition is often thought of as a flash of insight, but it is much more a part of everyday decision making than we realize. Consider driving a car. If you were constantly identifying all the options of what next to do, then weighing the pros and cons of each of these options, then picking a best option, you wouldn't get very far! We are very familiar with the "domain" of driving and often respond intuitively.

# Conditions Favoring Analytical and Intuitive Decision Making

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- Analytical:
  - Little time pressure
  - Goal is optimization (find the best option among many)
  - Computational complexity (cost effective analysis)
- Intuitive:
  - Significant time pressure
  - Dynamic conditions
  - Lives at stake



Though most decisions we make are a combination of analytical and intuitive thinking, there are environments better suited to one or the other. If I have to decide which new color copier to buy, I'll likely look at a number of copiers, weigh the different features and their associated costs, and come up with the best option. The NWS warning environment is one of significant time pressure, data uncertainties, complex communications and (often) lives at stake. This kind of environment is similar to firefighters, paramedics, the military, and other domains where decision making has been studied for many years. Researchers in the field of "naturalistic decision making" have discovered that intuition is an important component in decision making in these types of domains.

# The Role of Intuition

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



The intuitive response (aha!) is based on your experience, and sometimes it may be just a feeling. Experts in many fields have learned to use their intuition as part of their decision making process.

## Experts in Dynamic Domains Often Use Their Intuition

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- Pattern recognition
  - BWER in a developing storm
- Which data cues to look for
  - Mesocyclone in mid levels
- What is expected to happen next
  - Hook at low levels
- How to respond
  - Get that warning ready



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:

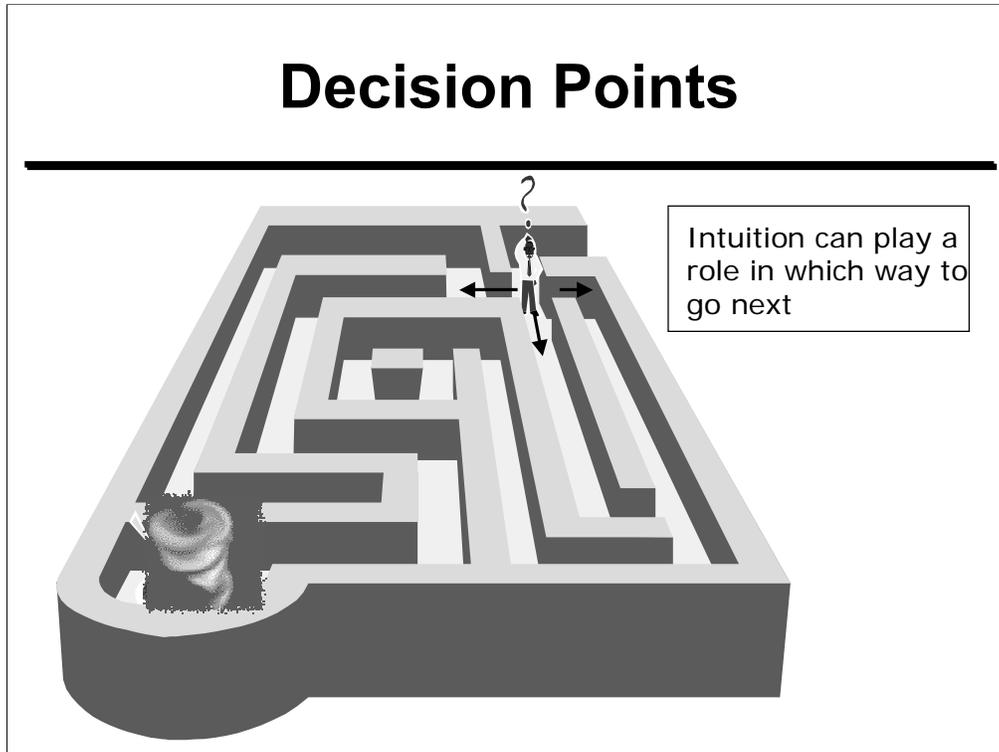
1. The data cues fit a pattern “it makes sense”:  
I’ve seen this before; I know what it means; I know what to look for; I know what to do
2. The data cues do not fit a pattern “it doesn’t make sense”:  
There is something missing here; something doesn’t seem right; step back and re-evaluate

The “aha” intuitive response happens when the data do fit a known pattern...“it makes sense”. The other possibility is that the data do not fit a pattern...“it doesn’t make sense”. In each case, the expert knows what to do following the intuitive response.



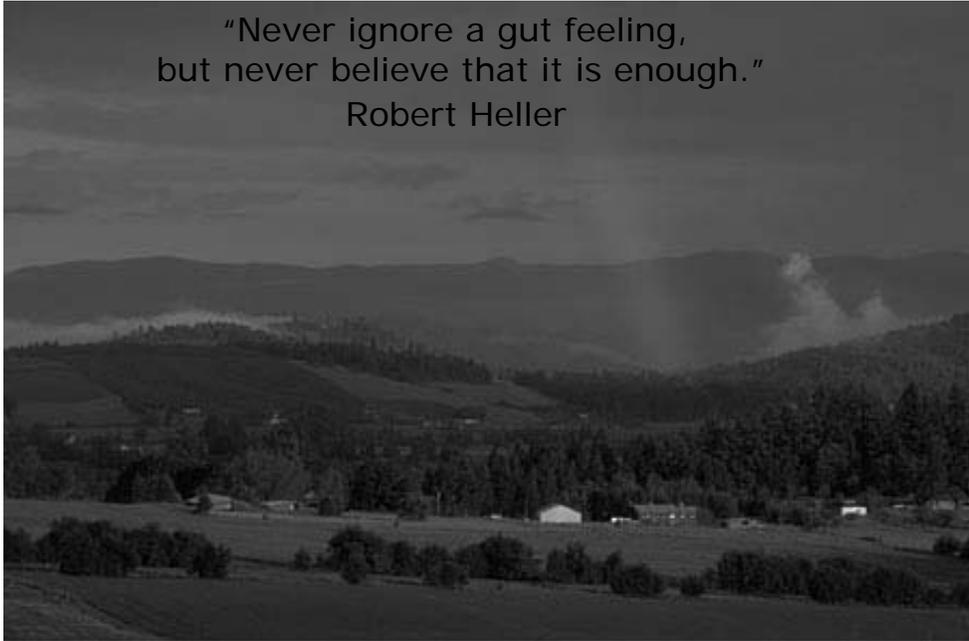
# Decision Points

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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.



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This concludes Lesson 1: The Warning Process and the Role of Intuition.  
There are three 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 [iccore2@wdtb.noaa.gov](mailto:iccore2@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 [iccore2@wdtb.noaa.gov](mailto:iccore2@wdtb.noaa.gov).