

Resolution of Ambiguity through HUMINT

An M&S Methodology



Briefing to ISMOR

29 August 2007

Topics

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- **Ambiguity on the Battlefield.**
- **Project Scope.**
- **Project Approach.**
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- **Summary & Status.**
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Project Overview

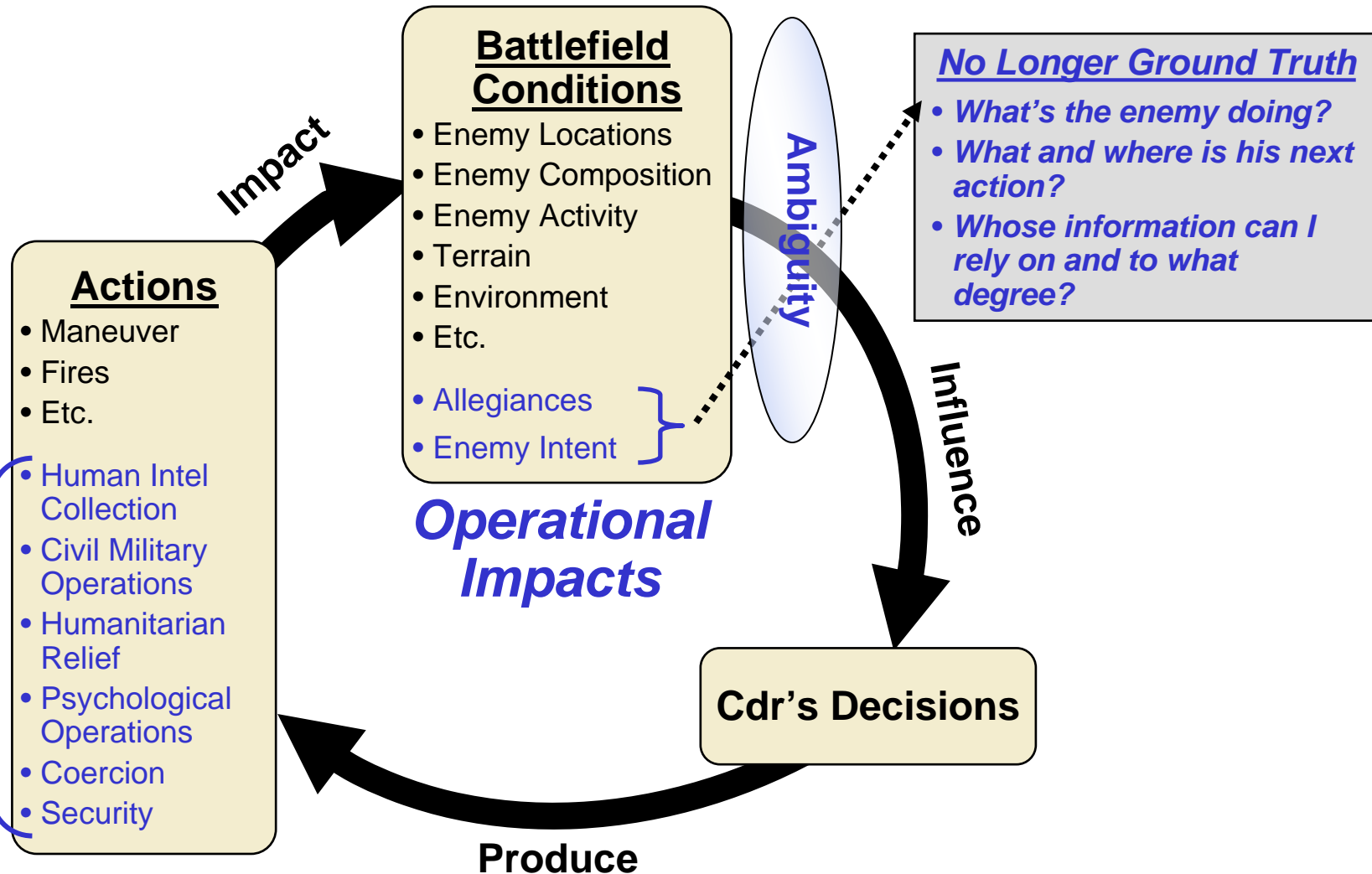
Problem: M&S generally do not portray the ambiguity that influences the operational decision making on the battlefield. Additionally, HUMINT, a source to help resolve ambiguity, is only portrayed in a gross, implicit way.

- **Project Purpose:** Develop model methodologies that can be used to better represent ambiguity and the contribution of HUMINT in resolving that ambiguity, where HUMINT is defined as:
 - *“The collection by a trained HUMINT collector of foreign information from people and multimedia to identify elements, intentions, composition, strength...”* (FM 2-0, Intelligence)
- **Project Result:** The resulting methodology prescribes, through requirements definition and model representations:
 - **Multiple sides** with varying and **dynamic allegiances**.
 - **Perceived truths** that include **enemy intent**.
 - Intelligence **source reliability** and **cooperation factors**.
 - HUMINT collection **functionality**.

The methodology provides a means for M&S to adapt to and represent the dynamic nature of today’s battlefield. The methodology is currently being implemented in both analytic and training models and helping revise doctrine.

Ambiguity on the Battlefield

The project's intent is to represent in M&S, the ambiguity a commander faces in making decisions, the actions he takes to resolve ambiguity (e.g., HUMINT), and their consequences in terms of the impacts on ambiguity and operations.



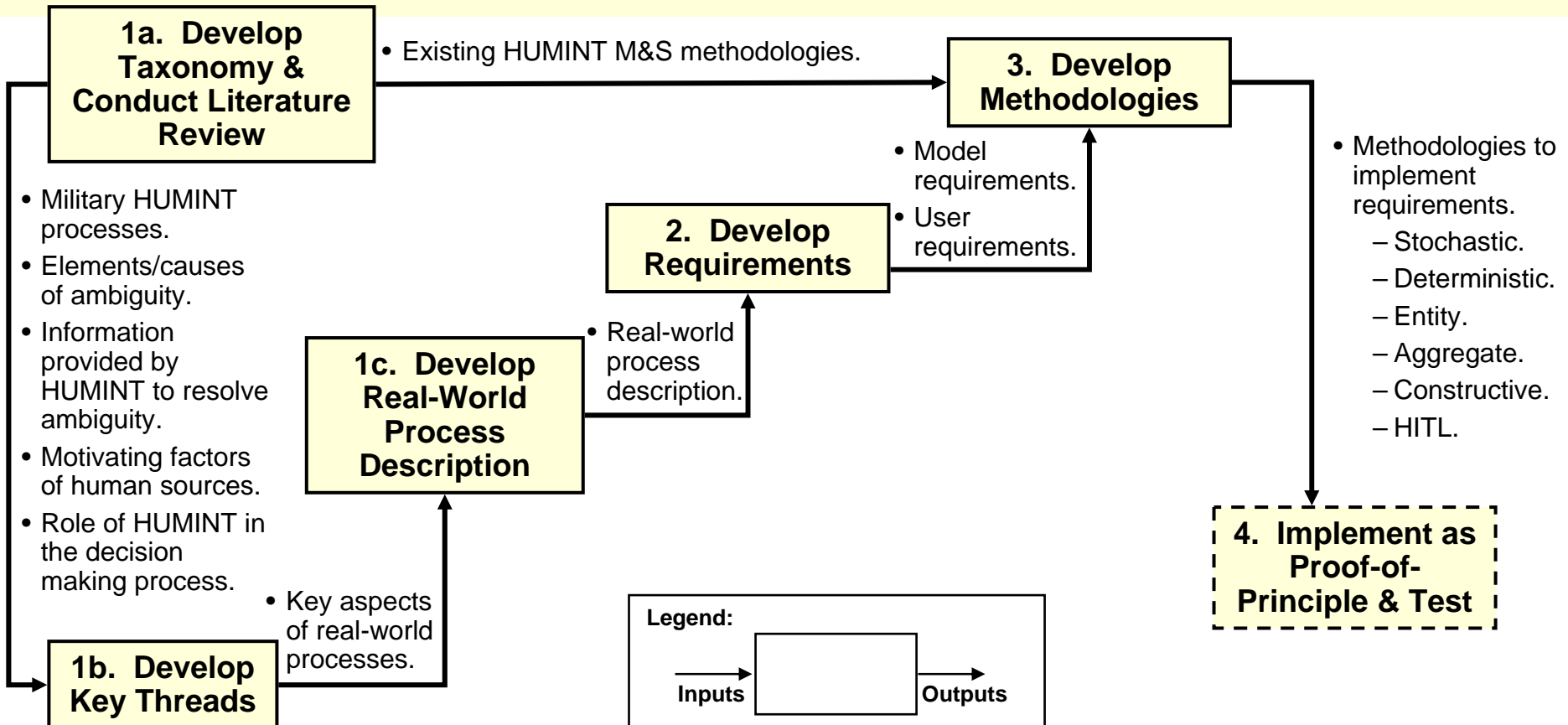
Project Scope

The team scoped the project to achieve credible representation while focusing on high-payoff factors.

- **Project focused on:**
 - Elements of ambiguity related to information quality and quantity as well as the commander's perception of the information.
 - Only *active* HUMINT collection, vice passive, where *active* is a collection effort initiated to ascertain specific information.
 - Representation of processes, capabilities, and effects at the tactical and operational levels.
 - Development of processes for combat simulation models, not performance or engineering models.
- **Resulting methodology adaptable for:**
 - Current and future operational environments, with Threat considerations represented in the data.
 - Aggregate and entity-level processes.
 - Deterministic and stochastic models.
 - Constructive and human-in-the-loop (HITL) models.
 - Analytic and training models.

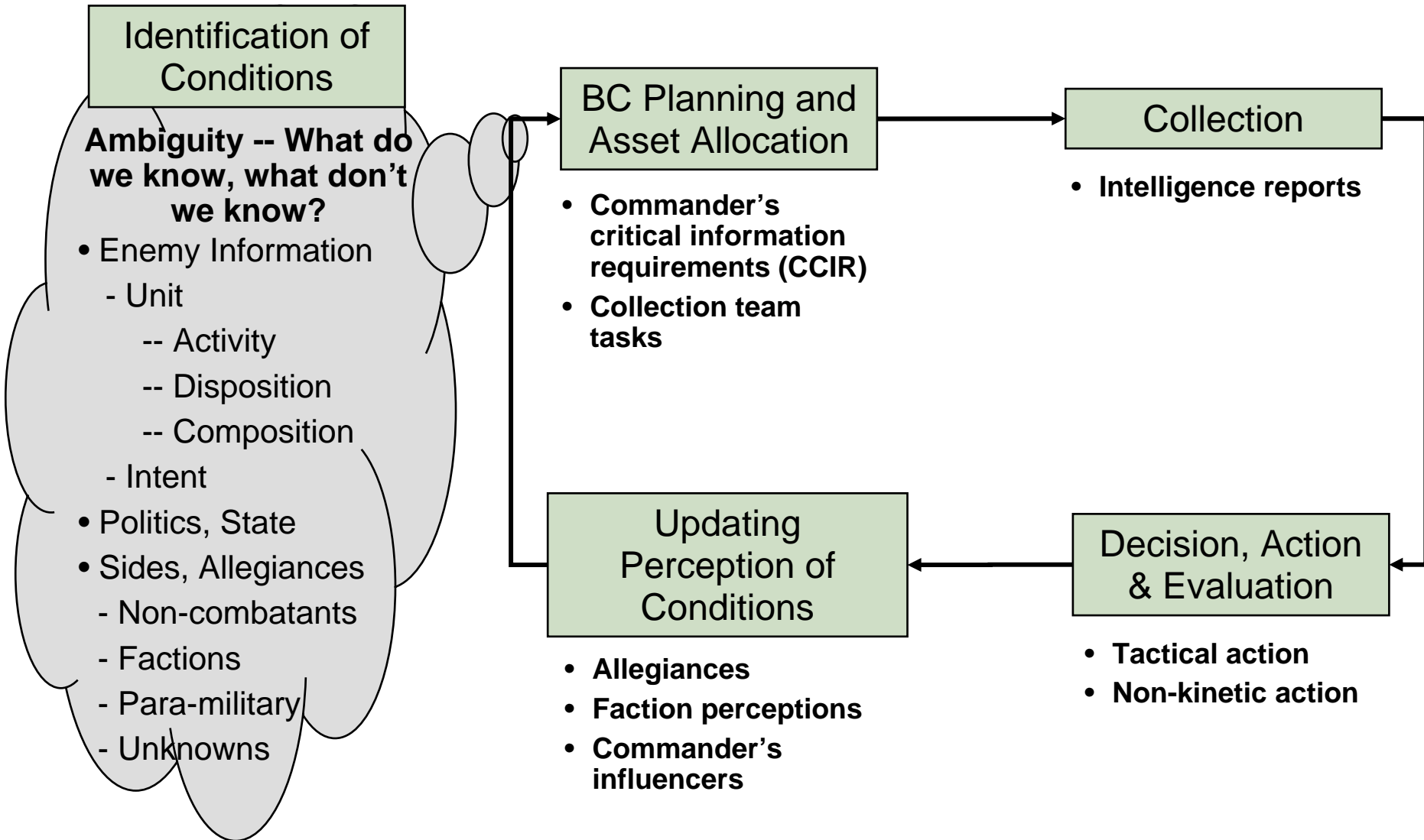
Project Approach

The approach consists of four principal stages:



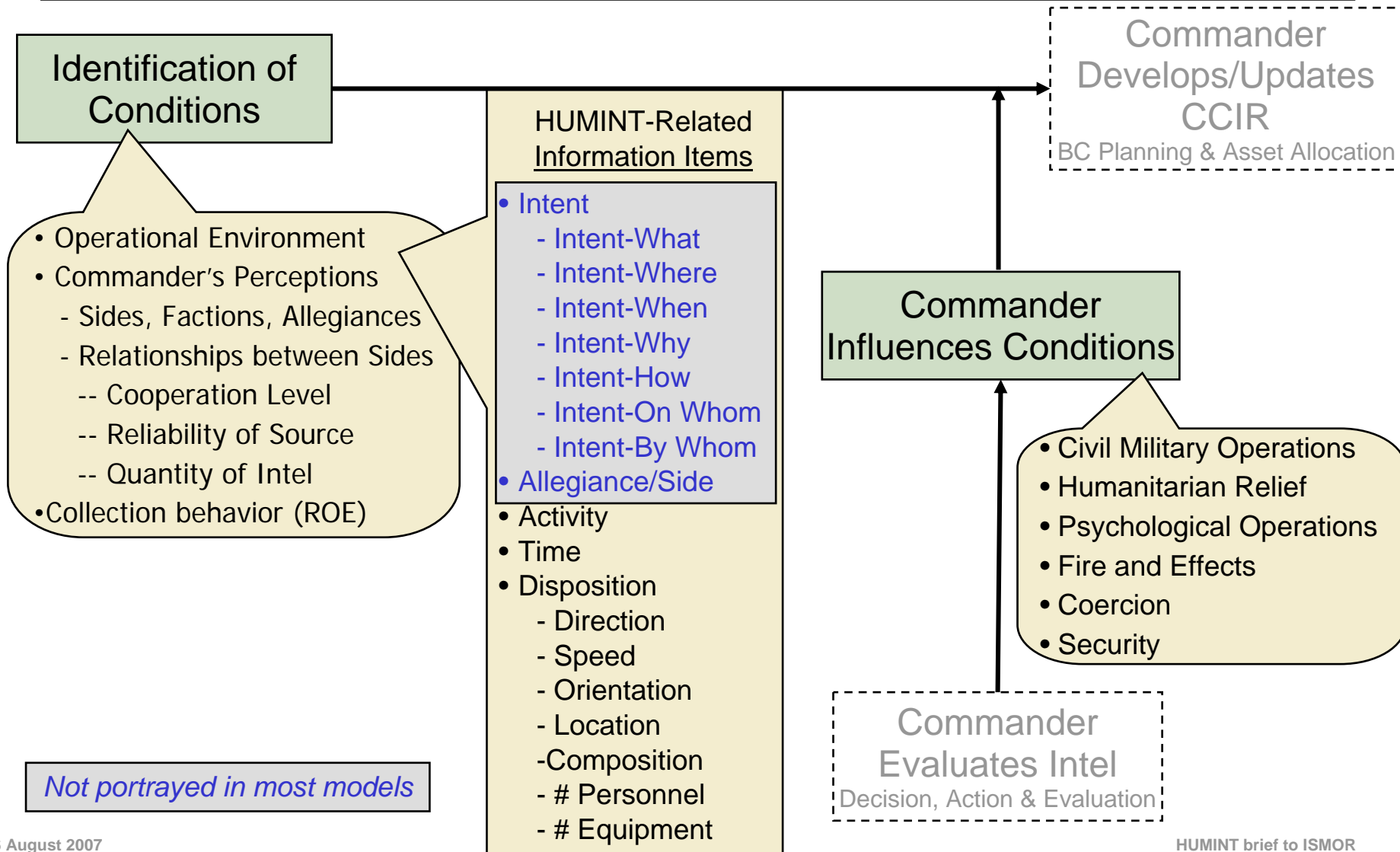
Ambiguity/HUMINT Methodology Overview

The Ambiguity/HUMINT methodology follows the real-world process.



Identification of Conditions

The methodology requires starting conditions that introduce ambiguous conditions and allow for the commander's influence of those conditions.



Cooperation Matrix

In the developed methodologies, the perceived cooperation levels between sides can be represented as percentages in a matrix.

Level	Range Band
Always Cooperative	99.9 to 100%
Very Cooperative	81 - 99.8%
Cooperative	61 - 80%
Marginally Cooperative	41 - 60%
Uncooperative	21 - 40%
Very Uncooperative	1 - 20%
Never Cooperative	0 - .9%

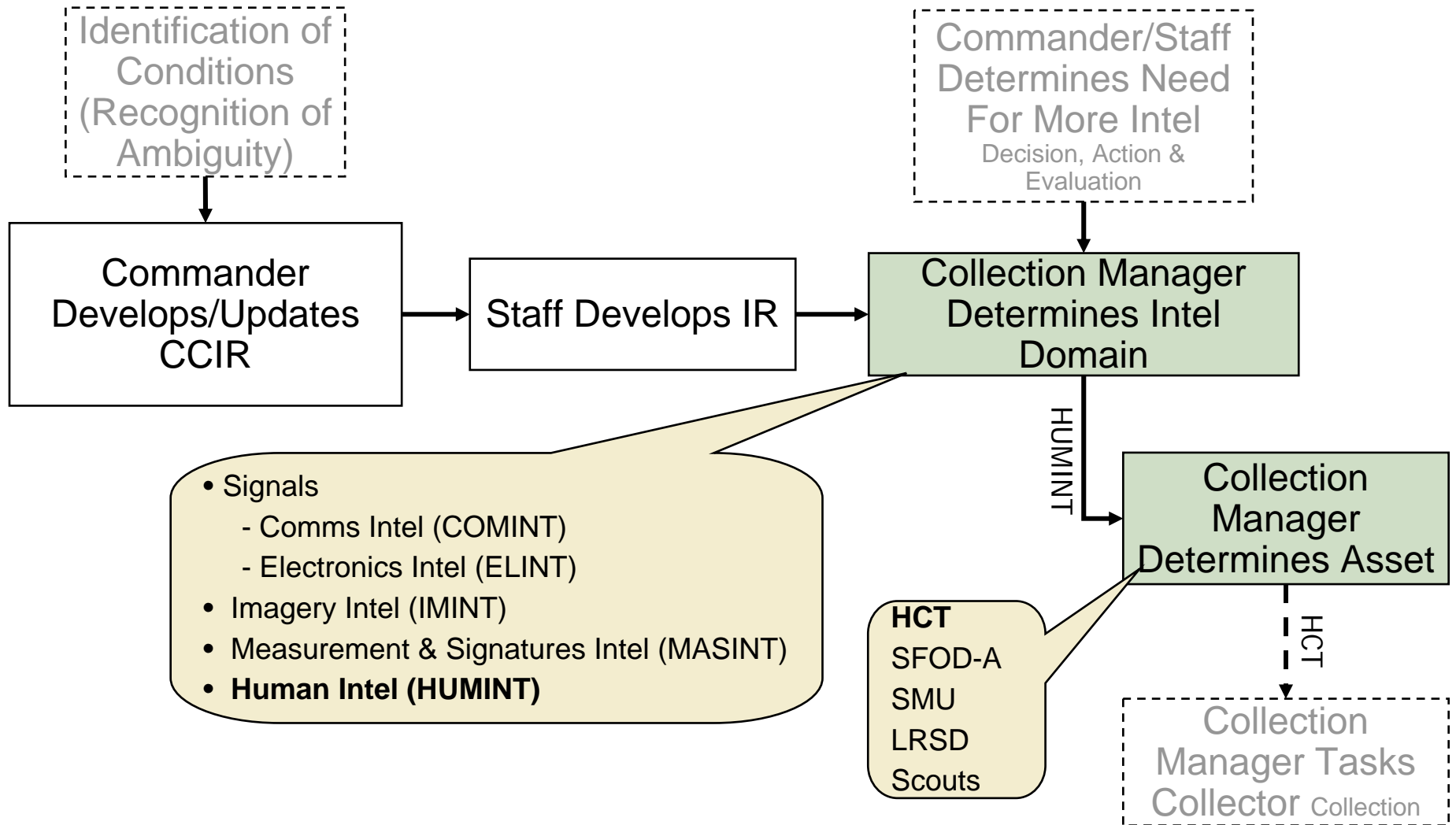
This range of percentages are used by the SME to establish the start condition or initial Cooperation Matrix.

		Provider of Intel				
		B	R	G	P	Y
Receiver of Intel	%					
	B	100	0	75	30	30
	R	0	100	15	60	1
	G	60	15	100	40	30
	P	1	75	30	100	1
	Y	1	1	25	1	100

Green provides 75% of its knowledge to Blue; while Blue only provides 60% to Green.

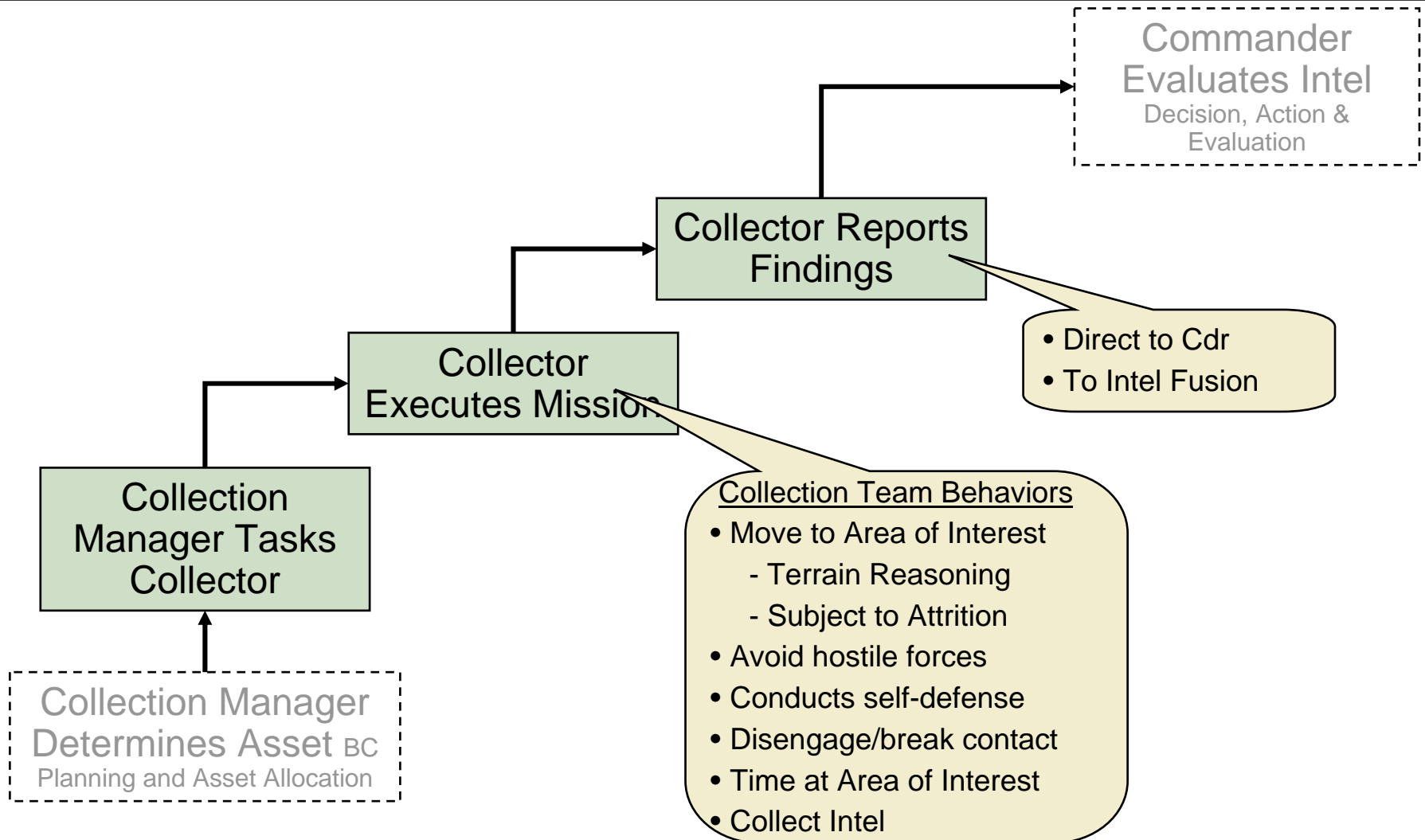
BC Planning and Asset Allocation

The starting point of all intelligence collections are the CCIR that focus available intel assets (human and mechanical sensors) on those collections.



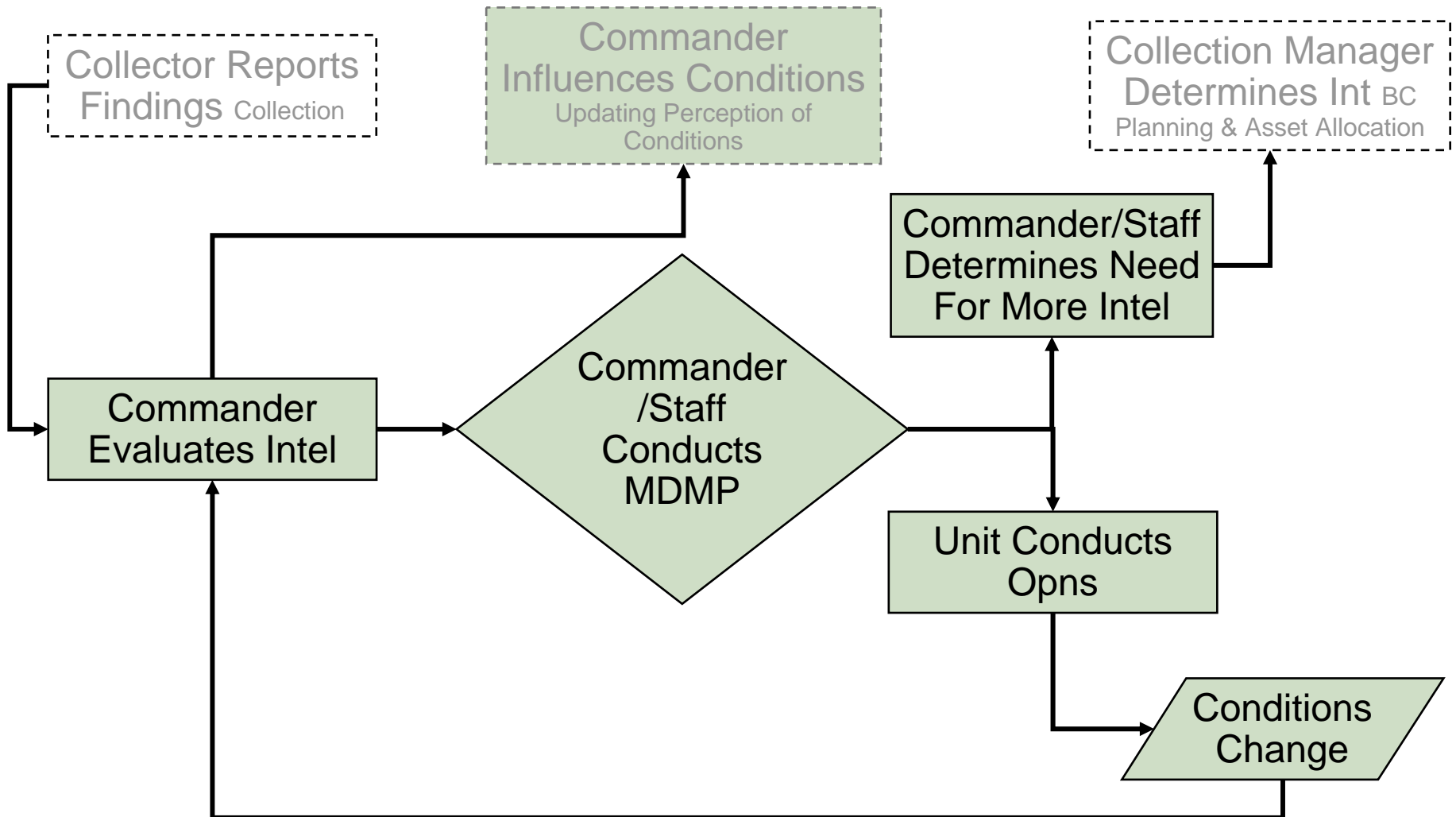
Collection

Subject to mission requirements, collectors of intel behave in much the same manner as any typical maneuver element (e.g., subject to attrition, detection) and report their findings for analysis and evaluation.



Decision – Action - Evaluation

Once evaluated, the intel may give the Commander reason for action in the form of tactical commitments or operational influencers.



Potential Actions for an Example Intent

The developed methodologies identify various actions to be taken depending upon the information gleaned.

If the following information is known:

If the following information is known:				
<p><u>Use Terrain as a Weapon</u></p> <ul style="list-style-type: none"> • Contaminate Food or Water • Rubble Buildings • Blow Dam • Start Fire • Generate Pollution • Start Refugee Movement 	<ul style="list-style-type: none"> • Where 	<ul style="list-style-type: none"> • By Whom or How • Where 	<ul style="list-style-type: none"> • By Whom • Location (By Whom) 	<ul style="list-style-type: none"> • By Whom (PSYOPS) • On Whom or Where (CMO/HRO)
The following minimal action can be taken:				
Action Taken:	Secure the 'Where'	Defend the 'Where'	Attack the 'By Whom'	Conduct Non-Kinetic Operation 'By Whom' or 'On Whom'

The 'By Whom', in this example provides the commander with the size force to defend against or attack.

Summary & Status

- **TRAC led the development of a first-of-its-kind methodology to provide the M&S community a framework for introducing ambiguity and HUMINT collection.**
 - Serves as the foundation from which methodologies can be effectively distilled and implemented across all M&S domains.
 - Provides avenue from which to evaluate the effectiveness of HUMINT collection in force-on-force models and could answer force structure questions regarding HUMINT collector needs and levels.
 - Informs doctrinal development (e.g., prior to this effort, no single document outlined the real-world process).
- **TRAC and others in the M&S community are currently implementing the methodology in both analytic and training models:**
 - Advanced Warfighting Simulation (AWARS) – Spring 08.
 - Objective OneSAF – Spiral 1 demo Oct 07.
 - JLCCTC – Spiral 1 validation Aug 08.
 - Joint Non-kinetic Effects Model (JNEM)
 - WARSIM Intelligence Module (WIM)
 - Maneuver models (WARSIM/CBS/JCATS)

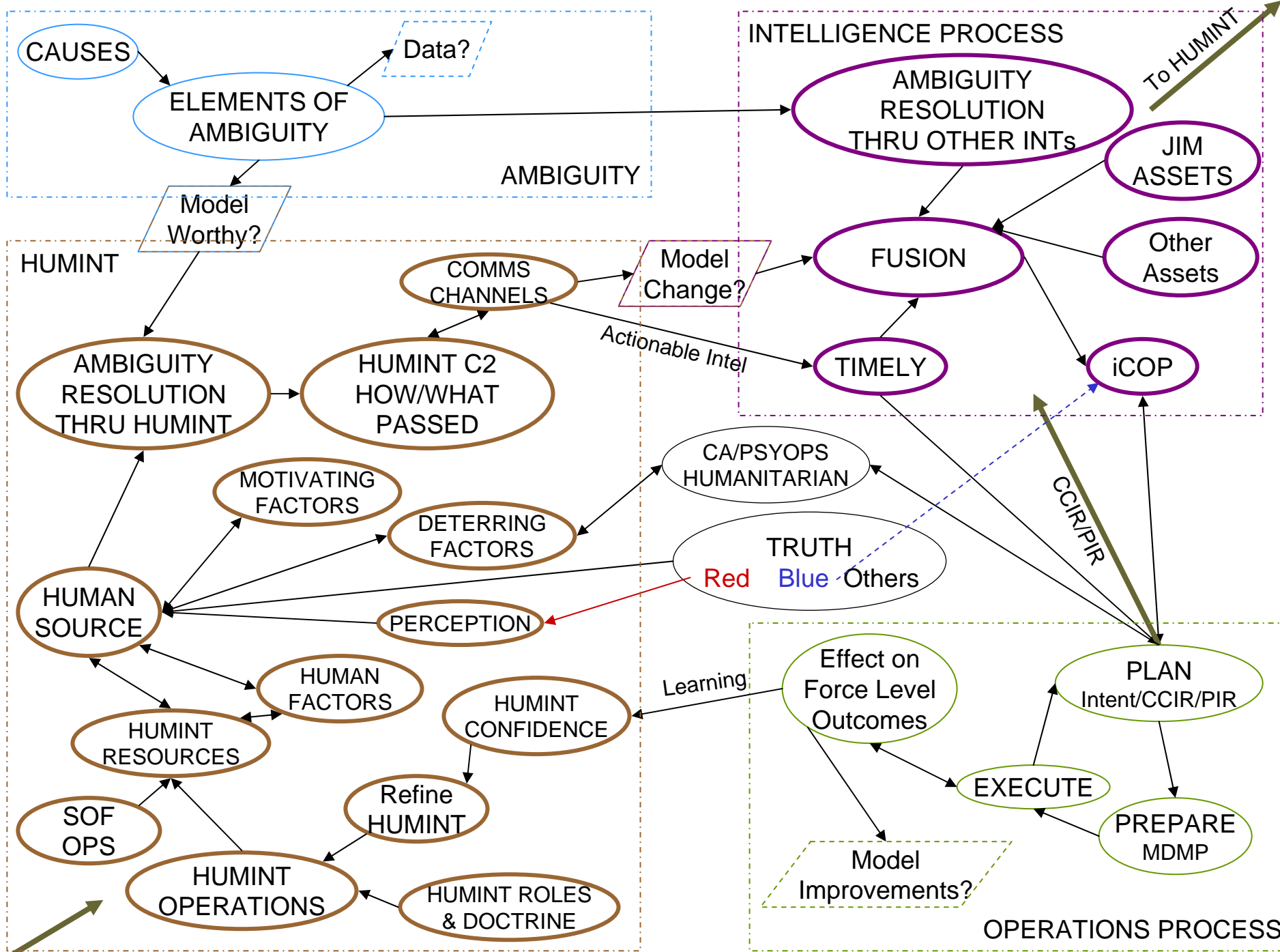
Questions

Information

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BACKUPS



Ambiguity Causes

- **Poor comms.**
- **Deception (includes media deception).**
- **Decoys.**
- **Terrain.**
- **Environment (weather, clutter, etc.).**
- **Sensor error.**
- **Information (too little/too much).**
- **Dynamic sides - changing allegiances.**
- **Media.**
- **Cultural shading.**

Ambiguity Elements

- **Threat information.**
 - **Unit.**
 - **Activity** – digging in, mobile, etc.
 - **Disposition** – location, orientation, posture, etc.
 - **Composition** – size, personnel, equipment, etc.
 - **Morale.**
 - **Tactics.**
 - **Intent.**
 - **ROE.**
- **Politics, state.**
- **Sides and allegiances.**
 - **Non-combatants.**
 - **Factions.**
 - **Para-military.**
- **Media.**

Gross and Specific Intents

Scenarios may drive the addition of other intents. The major bullets are considered aggregate, the lesser bullets are for entity level models.

- **Disrupt info / communications or infrastructure.**
 - Conduct jamming.
 - Conduct IO (CNA).
 - Disrupt power grid.
 - Interdict LOC / staging.
- **Use Terrain as a weapon / obstacle.**
 - Contaminate water, food supply.
 - Rubble buildings.
 - Blow dams.
 - Start fire.
 - Pollute.
 - Conduct refugee movement / displacement.
- **Bomb.**
- **Riot.**
- **Acquire weapons.**
 - Purchase weapons.
 - Manufacturing weapons.
 - Steal/hijacking weapons.
- **Conduct political / economic / social disruption.**
 - Plot assassination.
 - Kidnap or hold hostage.
 - Terrorize.
 - Blackmail.
 - Extort.
 - Conduct refugee movement / displacement.
 - Conduct strikes or demonstrations.
- **Conduct tactical / operational maneuvers (e.g. attack, defend, secure).**
- **Conduct irregular logistics.**
 - Establish serve and relocate cache network.
 - Establish serve and relocate safe houses.
 - Fund logistics efforts.
- **Impact allegiance / manipulate culture.**
 - Conduct PSYOPS.
 - Conduct CMO.
 - Conduct HRO.
 - Coerce.
 - Provide security.

HUMINT Asset Collection Criteria

Once the HUMINT domain is chosen in the M&S to collect the information attributes, then the developed methodologies identify the selection criteria for choosing the appropriate HUMINT asset to conduct the mission.

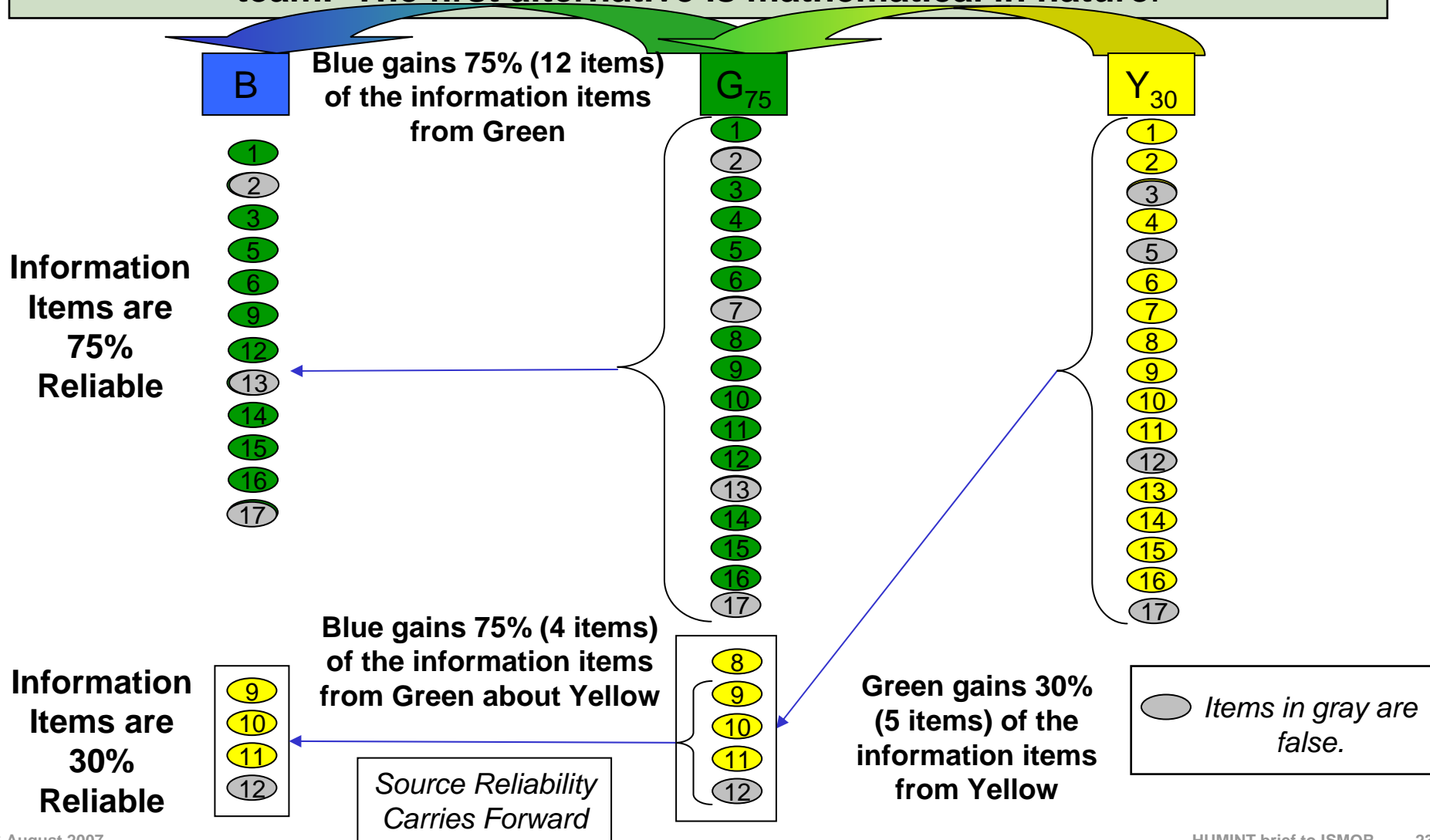
Criteria Collector	Permissive Environment	Availability	Mission	Proximity to Source	Permissive/ Proximity Priority
HCT	Full to semi	Yes/No	Info Collection	Inside BDE AOR	1 (Highest)
*Special Team (e.g. SFOD-A, SMU, LRSD & Scouts)	All	Yes/No	Info Collection & Tactical Mission	Inside/outside AOR	2

* Distinguishing characteristics of special collection teams include the associated equipment, personnel and capabilities. Assumes Special units are similar enough to represent as a whole.

Collection/Transfer of HUMINT Information (Mathematical Alternative)

Collection

The methodology provides two alternatives to represent the collection and transfer of HUMINT-related information from the source side to the collection team. The first alternative is mathematical in nature.



Collection/Transfer of HUMINT Information ("Ambiguity States" Alternative)

Collection

The second alternative, ambiguity states (AS), simplifies the method of collecting/transferring HUMINT information through static look-up tables.

- Ambiguity states (AS):
 - Each unit (or entity) has an AS based on its cooperation level with each other unit (entity).
 - The higher the cooperation level, the higher the state number (ground truth is AS5) and the less ambiguous.
- Information collected when units are in proximity:
 - All (true) intent-related attributes from AS5 units.
 - Unknown or misleading 'intent-what' and other selected intent-related attributes from AS1-AS4 units.
 - True, time-based, non-intent-related attributes (e.g., composition, sp regardless of AS.
- Example: Blue unit encounters green unit that has low cooperation level (10% from coop matrix); Blue:
 - Cannot determine 'intent-what.'
 - Collects only the correct inform regarding the 'by-whom.'

AS1	AS2	AS3	AS4	AS5
Unknown	Unknown	Disrupt Infrastructure	Use Terrain	Bomb
1% - 4% 5% - 8% 9% - 12% 13% - 16% 17% - 20%	21% - 25% 26% - 30% 31% - 35% 35% - 40%	41% - 47% 48% - 53% 54% - 60%	61% - 70% 71% - 80%	81% - 100%
• How ✓ When • By Whom • On Whom • Where	• How ✓ When • By Whom • On Whom • Where	• How ✓ When ✓ By Whom • On Whom • Where	• How ✓ When ✓ By Whom ✓ On Whom • Where	• How ✓ When ✓ By Whom ✓ On Whom ✓ Where

Influencing Operations

The methodology identifies the positive or negative effects of the influencing operations.

Influencer	Conducted by	Change to Coop. %*	Positive (+) or Negative (-) Influence
CMO	Red or Blue	10%	+ Influencer to Influenced - Influencer's Opponent both as: Receiver of Influenced & Provider to Influenced
HRO	Red or Blue	10%	+ Influencer to Influenced - Influencer's Opponent both as: Receiver of Influenced & Provider to Influenced
PSYOP	Red or Blue	10%	+ Influencer to Influenced - Influencer's Opponent both as: Receiver of Influenced & Provider to Influenced
F & E	Combatant sides	40%	- Influencer to Influenced
Coercion	Red Only	30%	+ Red (Influencer) to Influenced - Blue (Influencer's Opponent) both as: Receiver of Influenced & Provider to Influenced
Security	Blue Only	10%	+ Blue to Influenced - Red (Influencer's Opponent) both as: Receiver of Influenced & Provider to Influenced

* Percentages are default values and can be adjusted based on SME input at scenario generation. Factors are applied at the time of event (once every 24 hours for aggregate level or every 6 hours for entity level).

Influencing Operations (Impact on Perceived Cooperation Levels)

The methodology identifies the effects of the influencing operations on the perceived cooperation levels.

Example: Blue conducts HRO with Green

%	B	R	G	P	Y
B	100	0	75	30	30
R	0	100	15	60	1
G	60	15	100	40	30
P	1	75	30	100	1
Y	1	1	25	1	100

Baseline Cooperation Levels
(Established by SME)

+ Influencer to Influenced (10% gain)
- Influencer's Opponent both as:
Receiver of Influenced (10% loss)
Provider to Influenced (10% loss)

Influenced / Provider of Intel

%	B	R	G	P	Y
B	100	0	75 → 82.5	30	30
R	0	100	15 → 13.5	60	1
G	60 → 13.5	15	100	40	30
P	1	75	30	100	1
Y	1	1	25	1	100

Influencer \ Receiver of Intel

Revised Cooperation Levels
(after Influencing Operation)

Ambiguity and Effects

Ambiguity Elements

- Threat Information
 - Unit
 - Activity
 - Disposition
 - Composition
 - **Morale**
 - **Tactics**
 - Intent
 - **ROE**
- **Politics, State**
- Sides, Allegiances
 - Non-combatants
 - Factions
 - Para-military
 - Unknowns
- **Media**

- **Elements in red not addressed with methodology**
- **Elements in blue already addressed in AWARS to some degree**

HUMINT Effects on Ambiguity

- Comparison of perceived vs. ground truth (what is known, what we could have known)
- # IEDs avoided/discovered
- Increase/decrease in casualties
- Allegiance changes (good and bad)
- HVT identified earlier/later
- % HUMINT Info transferred to COP
- # IR/CCIR satisfied
- Actionable HUMINT to BC (to include mission changes due to HUMINT info)
- Amount of HUMINT info corroborated by other INTs
- Increased/Decreased Situational Awareness & Situational Understanding

Operational Effects

- # Targets acquired
- # Targets destroyed
- % Fratricide
- # Casualties
- # HPT killed
- Impact on OPTEMPO
- Synchronization of Forces
- Expenditure of Resources
- Success/Failure of Mission
- Etc.

Addressing FALSE Information

IPT (SMEs) developed false information approach, though agreed not the best, it is a viable method for applying falseness to information attributes.

- **For stochastic models: Use random seed to determine which attributes are false before conducting collection algorithms.**
- **For deterministic models: Use pre-determined number sets, which adjust after every use, to determine which attributes are false. Again, determine false attributes before conducting collection algorithms or applying ambiguity states.**

Timeline for Collecting Information

CoRe Matrix Value (source as provider to collector as receiver)	0 to 20%	21 to 40%	41 to 60%	61 to 80%	81 to 100%
Time Delay for collection activity	90 min	75 min	60 min	45 min	30min

USAIC says should allow for plus-ups based on:

- Cultural awareness, ice breakers (pleasantries) + 30 min
- Mission type; general vs. specific collection
- Intent type; details specific to intent can vary.