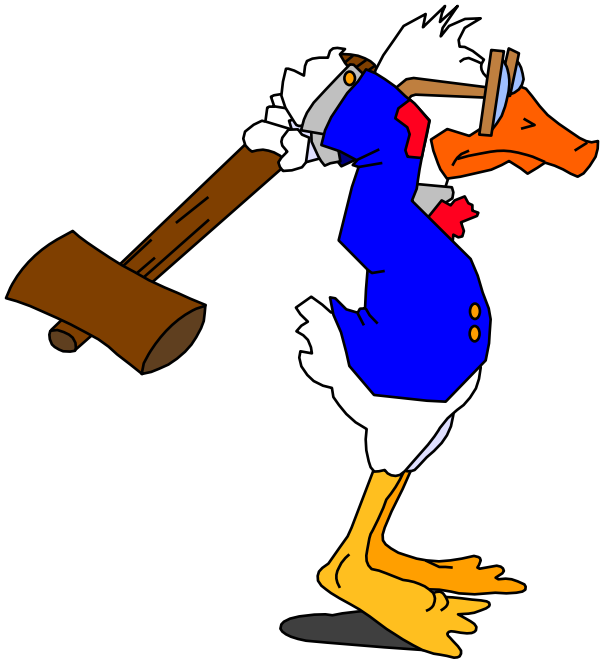
Insensitive Munitions Analytical Compliance System (I-MACS) Concept



2007 Insensitive Munitions & Energetic Materials Technology Symposium
Miami, FL
October 16, 2007

CCS
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Chemical Compliance Systems, Inc.
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Insensitive Munitions
(OSD & NATO)

"…munitions which reliably fulfill their performance, readiness and operation requirements on demand, but which minimize the probability of inadvertent initiation and severity of subsequent collateral damage to weapon platforms, logistic systems, and personnel, when subjected to unplanned stimuli."

BENEFITS

- Enhanced survivability of logistical and tactical systems
- Reduced risk of injury to personnel
- Applicability across services/platforms
- More efficient to transport, store and handle
- More cost effective

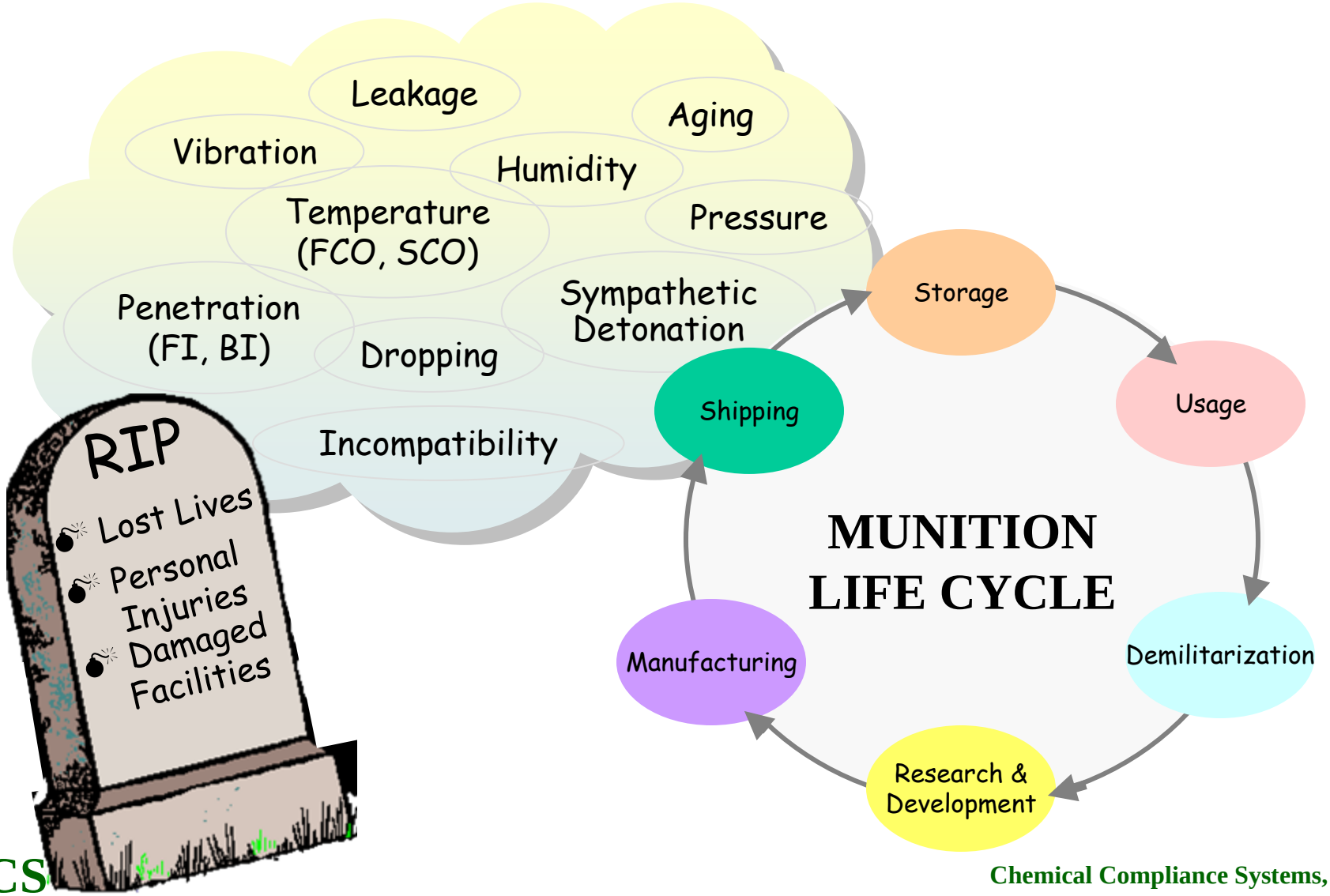
Historic Incidences

(Four Aircraft Carrier Accidents in 1966, 1967, 1969 & 1981)[a]

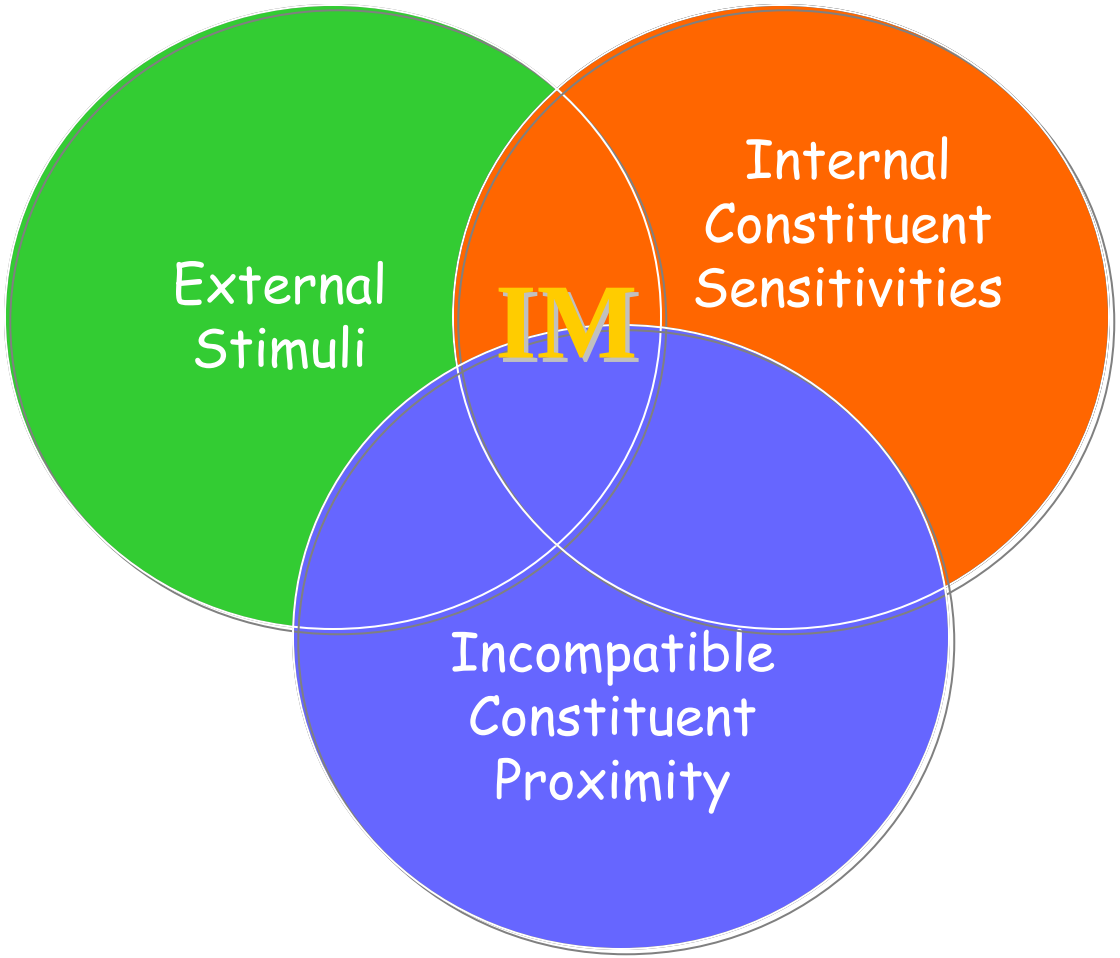
	ACTUAL STATISTICS	IM MUNITION EST'D	% ↓	EST'D SAVINGS
Lives Lost	220	72	67	$148M
Injuries	709	132	81	577M
Aircraft Lost	42	10	76	32M
Aircraft Damaged	72	12	83	60M
Potential Total $ Savings				**$1.4B**

a From 1991 CNA Study

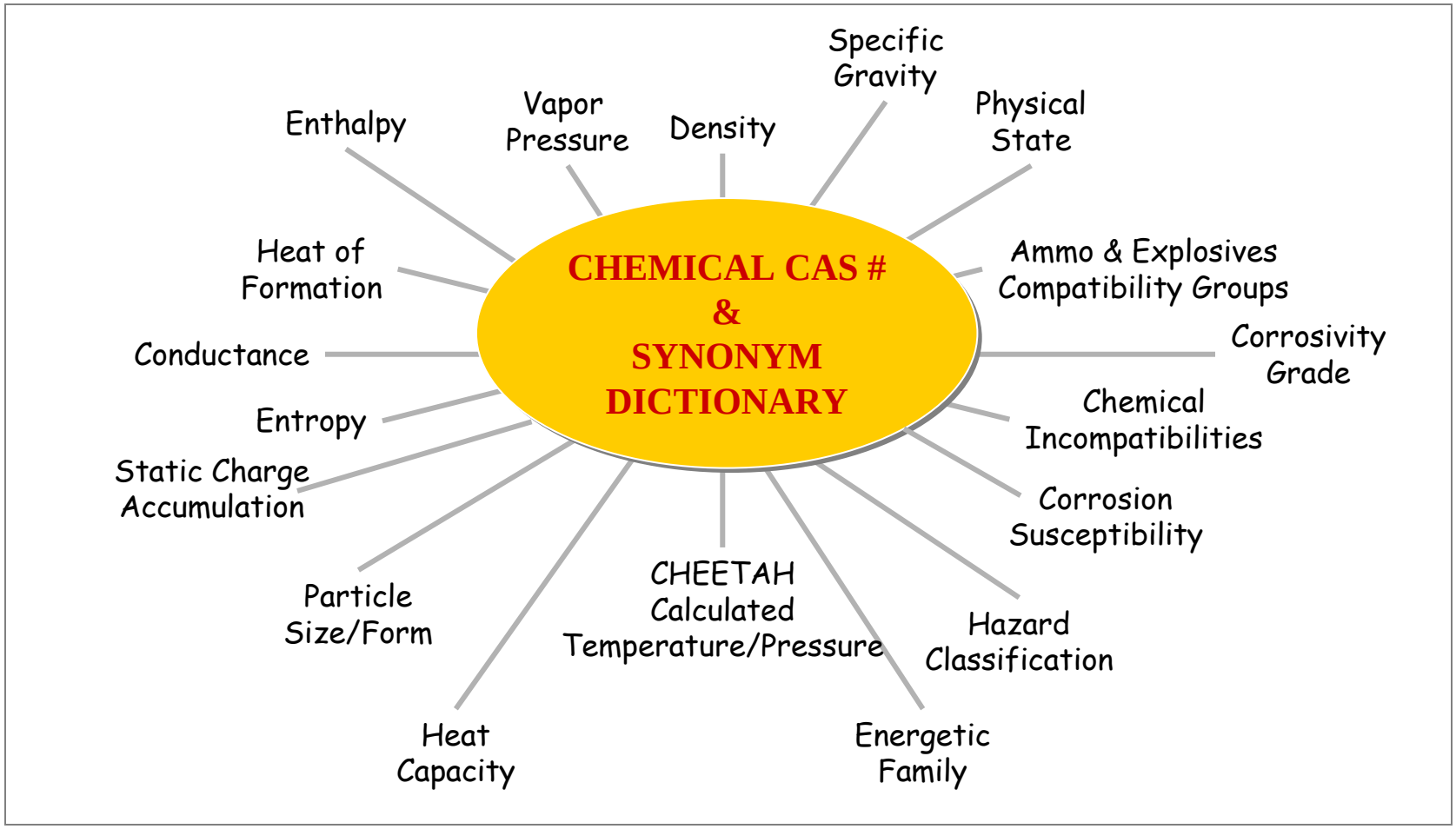
Munitions Life Cycle Unplanned Stimuli



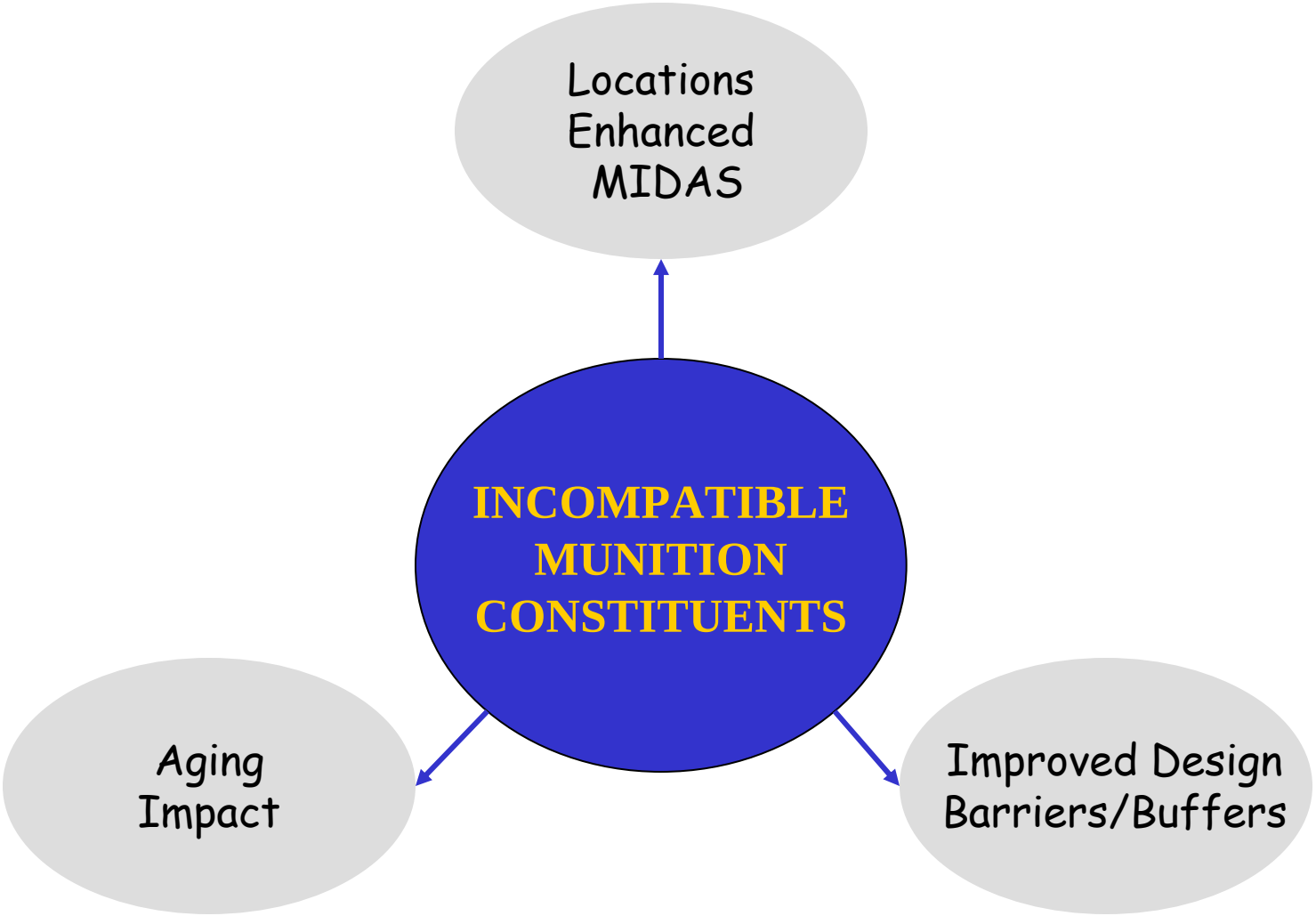
Sources of Weapon System Vulnerabilities



Sensitive Constituents Database Endpoints



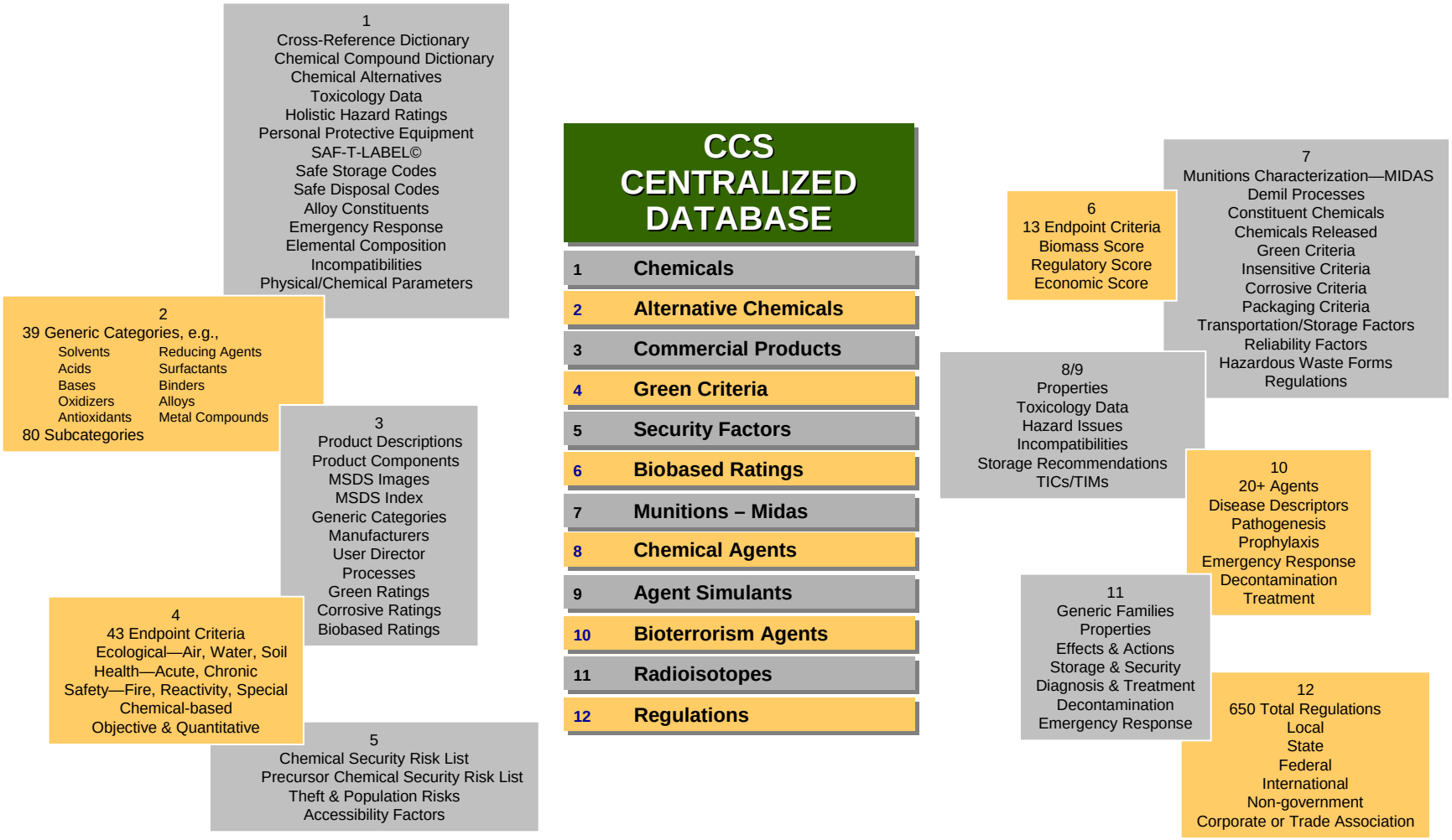
Incompatible Chemical Proximity Database



Hurdles for Developing Insensitive Munitions

"HURDLE"	SOLUTION
1. The problem is extremely complex	1. Utilize "outside the box" thinking
2. IM is only one of the problems	2. Start — Integrate — Enhance
3. Some test protocols are not standardized	3. Begin with a standardized data repository
4. Some IM test results are not standardized, nor shared	4. Develop a Centralized Database--require submissions
5. IM Test Data must be secure	5. Obtain DoD & NSA clearance for I-MACS Security
6. Incident "Root Cause" Analyses are not in a database	6. Develop a chemical-based "Root Cause" for each incident

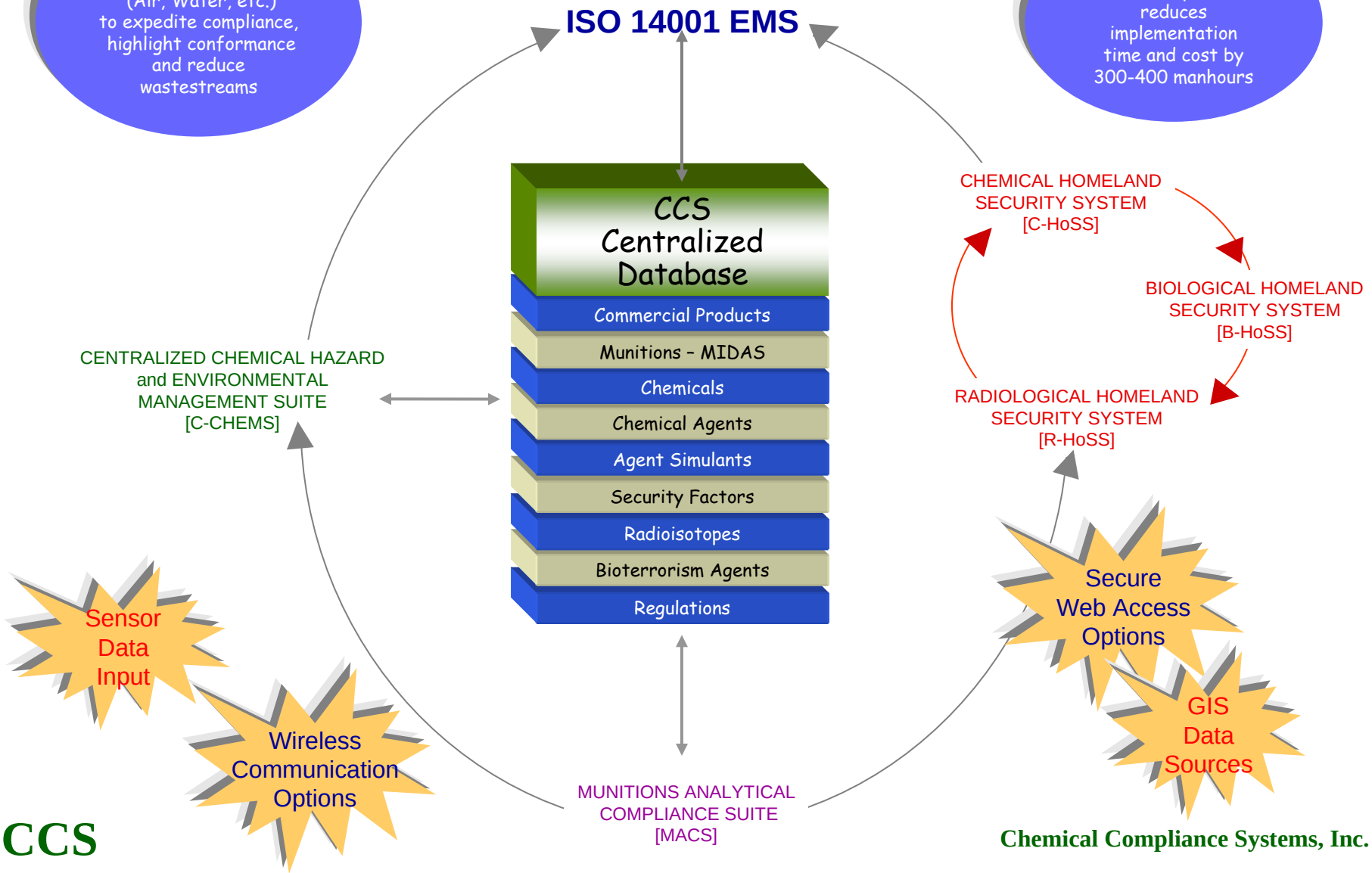
The CCS Relational Chemical & Product Database (R–CPD)



CCS Capabilities

ISO 14001 draws regulatory data (Air, Water, etc.) to expedite compliance, highlight conformance and reduce wastestreams

Web-based ISO 14001 System reduces implementation time and cost by 300-400 manhours



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Munitions Analytical Compliance Suite (MACS)

MACS–PODS
(Client–Server)

INC-FRCS
(Web)

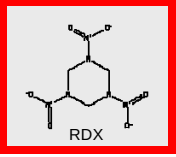
MACS–1
Demil
(Web)

Dispersion RISK
(Web)

U–MACS
UXO Remediation
(Concept)

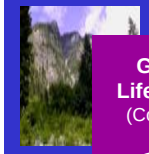
TRACS
Hazardous Waste
(Web)

MACS–COC
Chemicals of Concern



G–MACS
Green Munitions
(Web)

Green Energetics
(Proposal)



Green Life Cycle
(Concept)

C–MACS
Corrosives
(Proposal)

MACS Centralized Databases

- Munitions Characterization – MIDAS
- Demil Processes
- Constituent Chemicals
- Chemicals Released
- Concern Criteria
- Green Criteria
- Insensitive Criteria
- Corrosive Criteria
- Packaging Criteria
- Transportation/Storage Factors
- Reliability Factors
- Hazardous Waste Forms
- Regulations

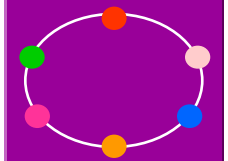
RATS
Range Assembly
(Concept)

MACS–2
Ranges
(Web)

MACS–3
Theoretical Compliance Analyses
(Web)

MACS–ERA
Emission Risk
(Web)

MLCMT
(Concept)

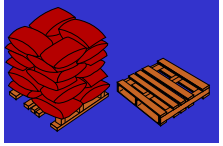


MACS–HRA
Health Risk
(Web)

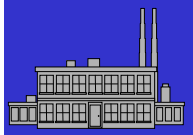
I–MACS
Insensitive Munitions
(Proposal)

ARAS
Ammo Reliability
(Concept)

MACS–4
Sources & Shortages
(Proposal)



MACS–5
Manufacturing
(Proposal)



MACS–6
Storage & Packaging
(Concept)

◆ Modules currently available on the World Wide Web
● Modules currently with submitted proposals
✖ Modules in the defined concept stage
■ Modules currently available as a client–server system

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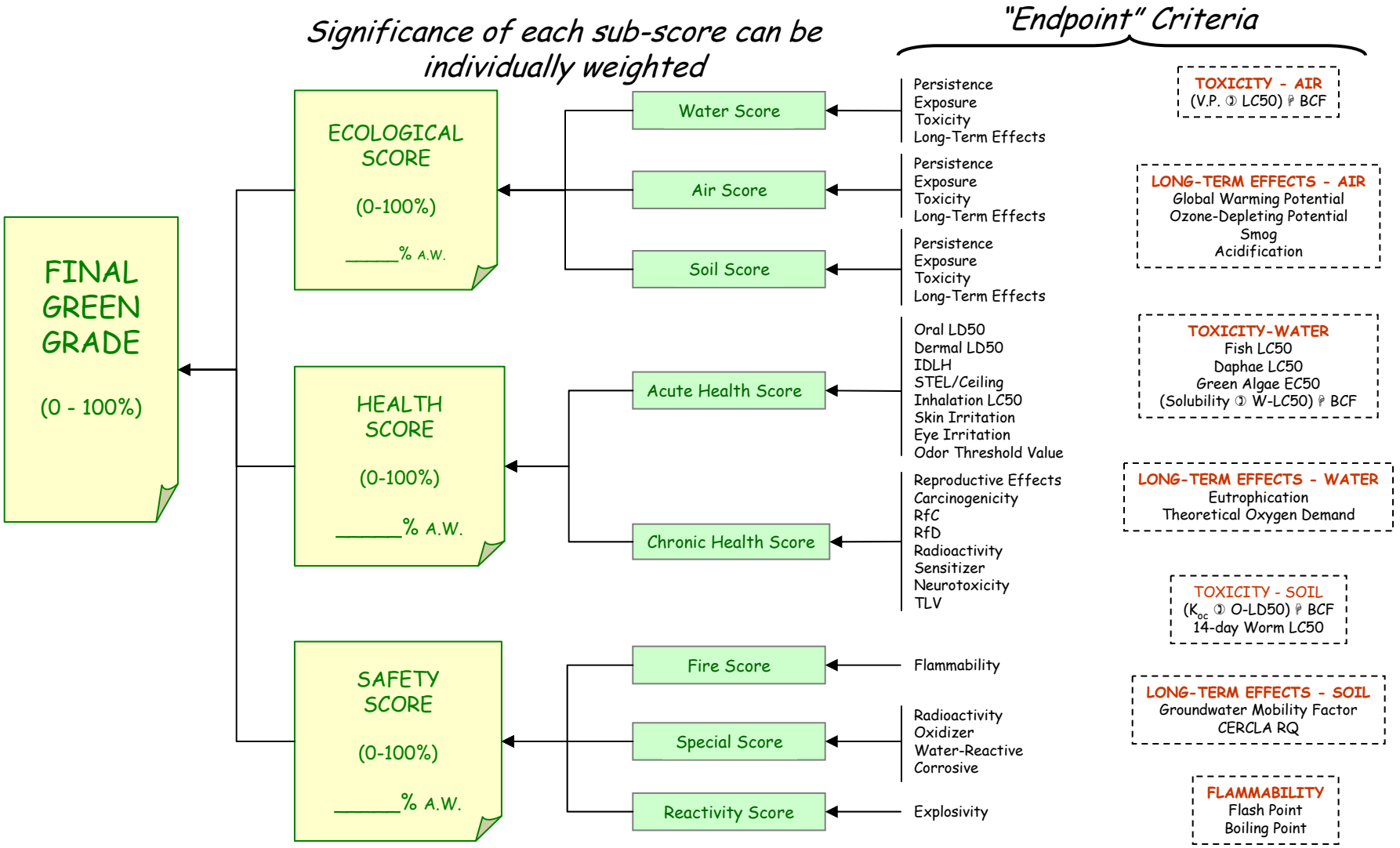
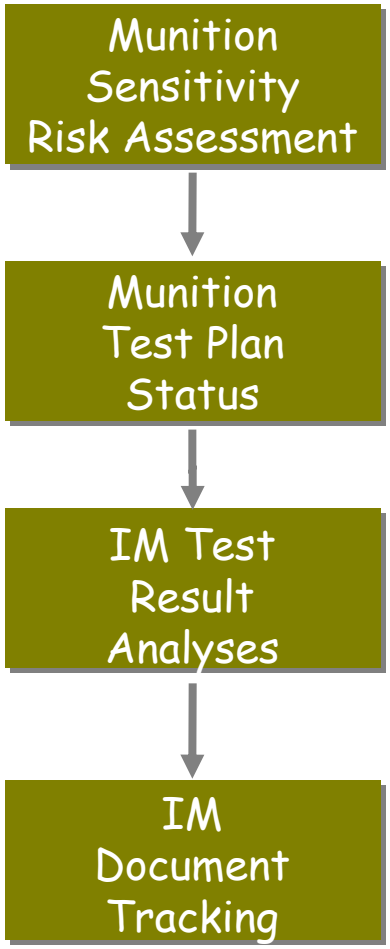
("Green" Munitions Analytical Compliance System)

G–MACS "Green" Score Scheme



I-MACS System Components



Main Menu Screen

MACS-1
Analytical
Input Results

Munition
Sensitivity
Risk
Assessment

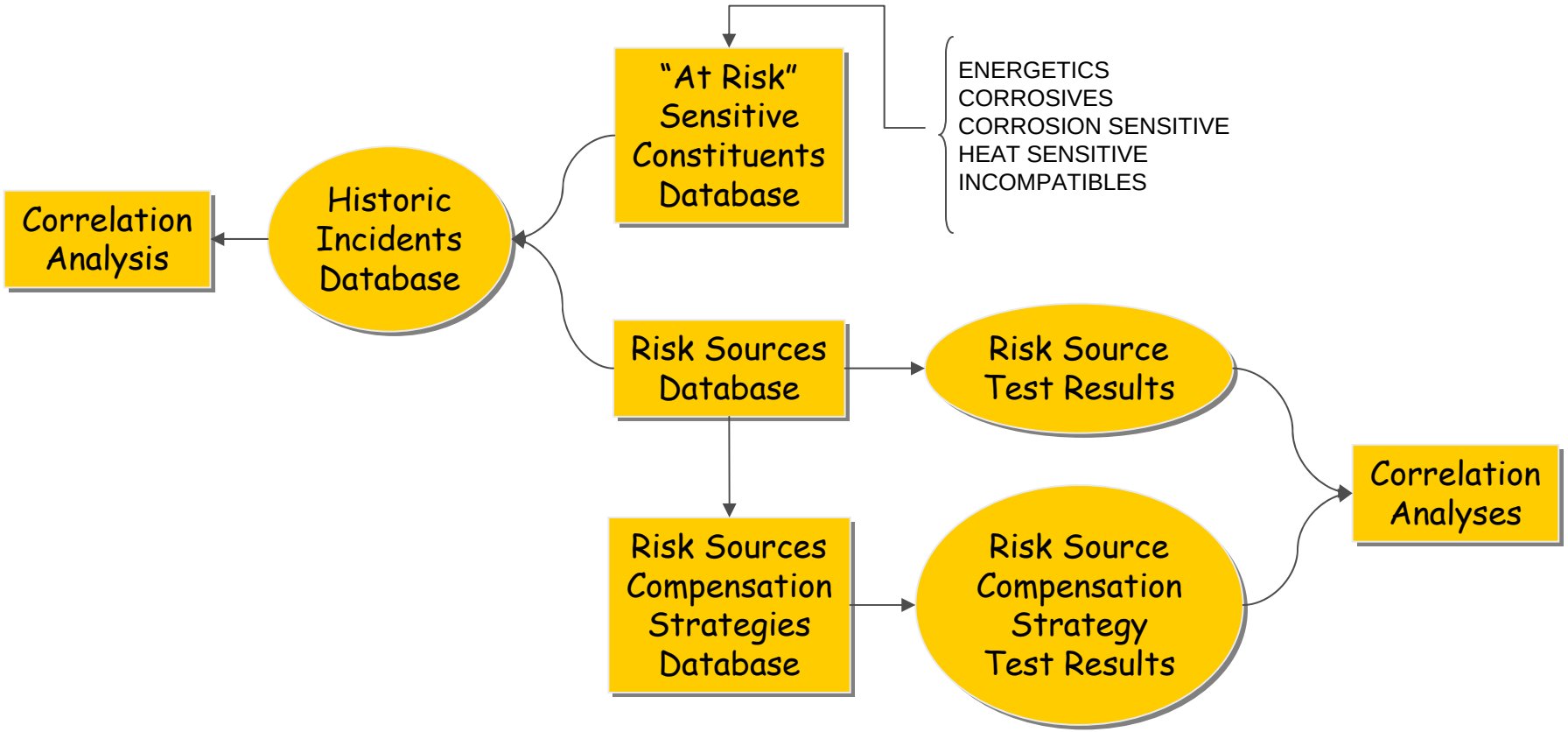
IM
Test Plan
Status

IM
Test Result
Analyses

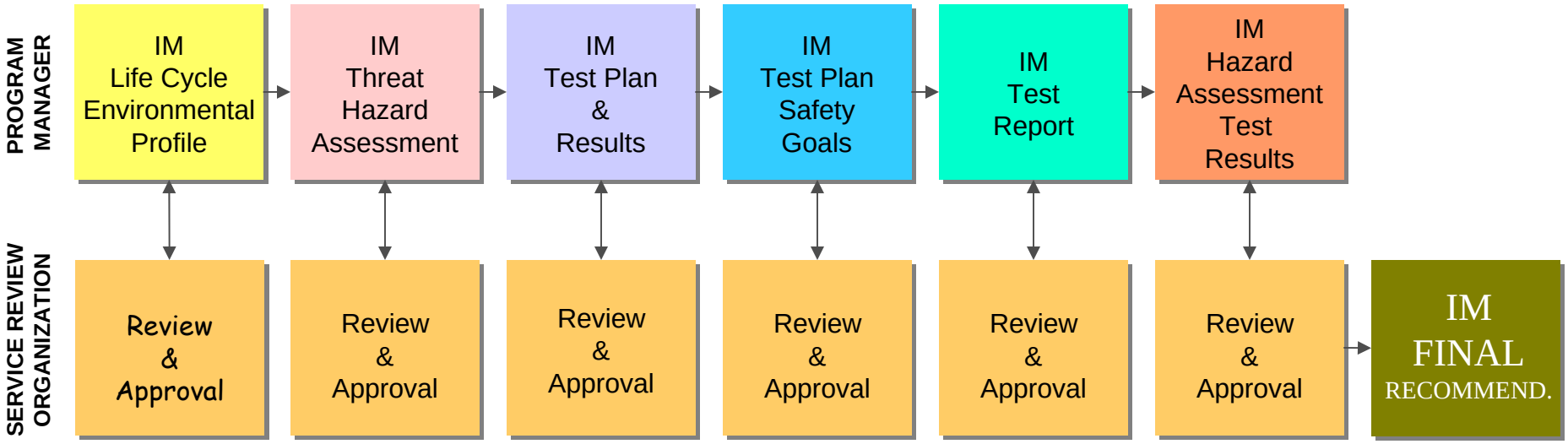
IM
Document
Tracking

I-MACS
Analytical
Results Output
(to G-MACS)

Munition Sensitivity Risk Assessment Algorithms



Test Plan Status & Document Tracking



Test Plan & Results

28-Day Temperature & Humidity Test	Vibration Test	4-Day Temperature & Humidity Test	12-Meter Drop Test
Fast Cook-Off Test	Slow Cook-Off Test	Bullet Impact Test	Fragment Impact Test
Sympathetic Detonation Test	Shaped Charge Jet Impact Test	Spall Impact Test	_____ _____ Specialty Test
_____ _____ Specialty Test	_____ _____ Specialty Test	_____ _____ Specialty Test	_____ _____ Specialty Test

5.2.1 I-MACS Fast Cook-Off Test Results

ITEM NO.	*Engulf at least two test items in the flame envelope (complete engulfment).*
Visual Inspection	Normal _____ Abnormal (*describe*) _____
Radiographic Inspection	Normal _____ Abnormal (*describe*) _____
Position	Major Axis Horizontal _____ Most Probable Attitude (*describe*) _____
Distance from Fuel Basin	(Item Centerline to Fuel Surface) _____mm
Restraining Method	
Suspension Method	
Fuel Type	
Flame Temperature Rise Time (time to reach 540°C=1000°F)	

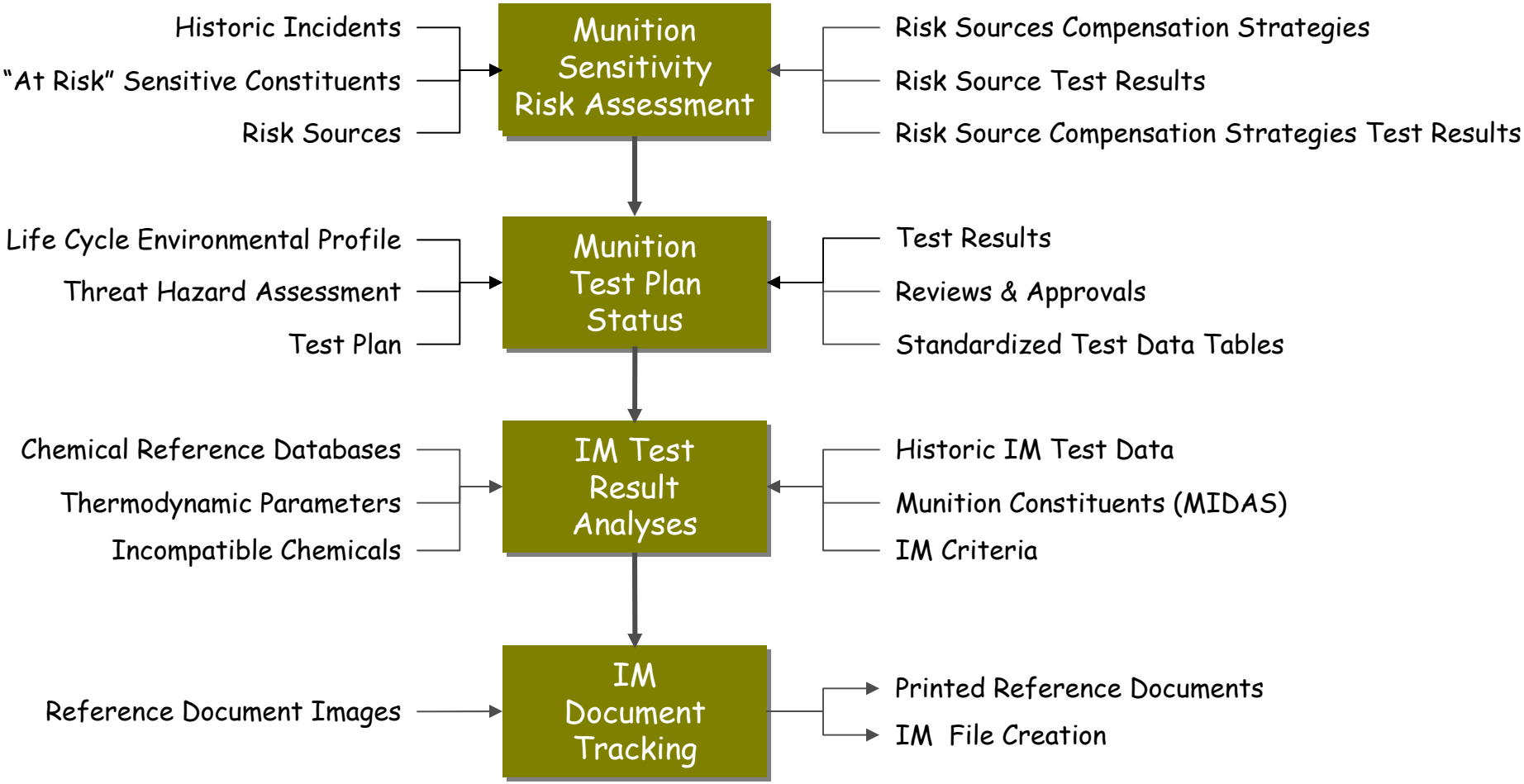
AVERAGE FLAME TEMPERATURE: _____°C (≥870°C = 1600°F)

PHOTOGRAPHY: [1] Still Pretest_____ Post-Test _____
[2] Videotape w/sound _____

TEST RESULT SUMMARY
1. Type 1 (Detonation Reaction)
2. Type 2 (Partial Detonation Reaction)
3. Type 3 (Explosion Reaction)
4. Type 4 (Deflagration Reaction)
5. Type 5 (Burning Reaction)

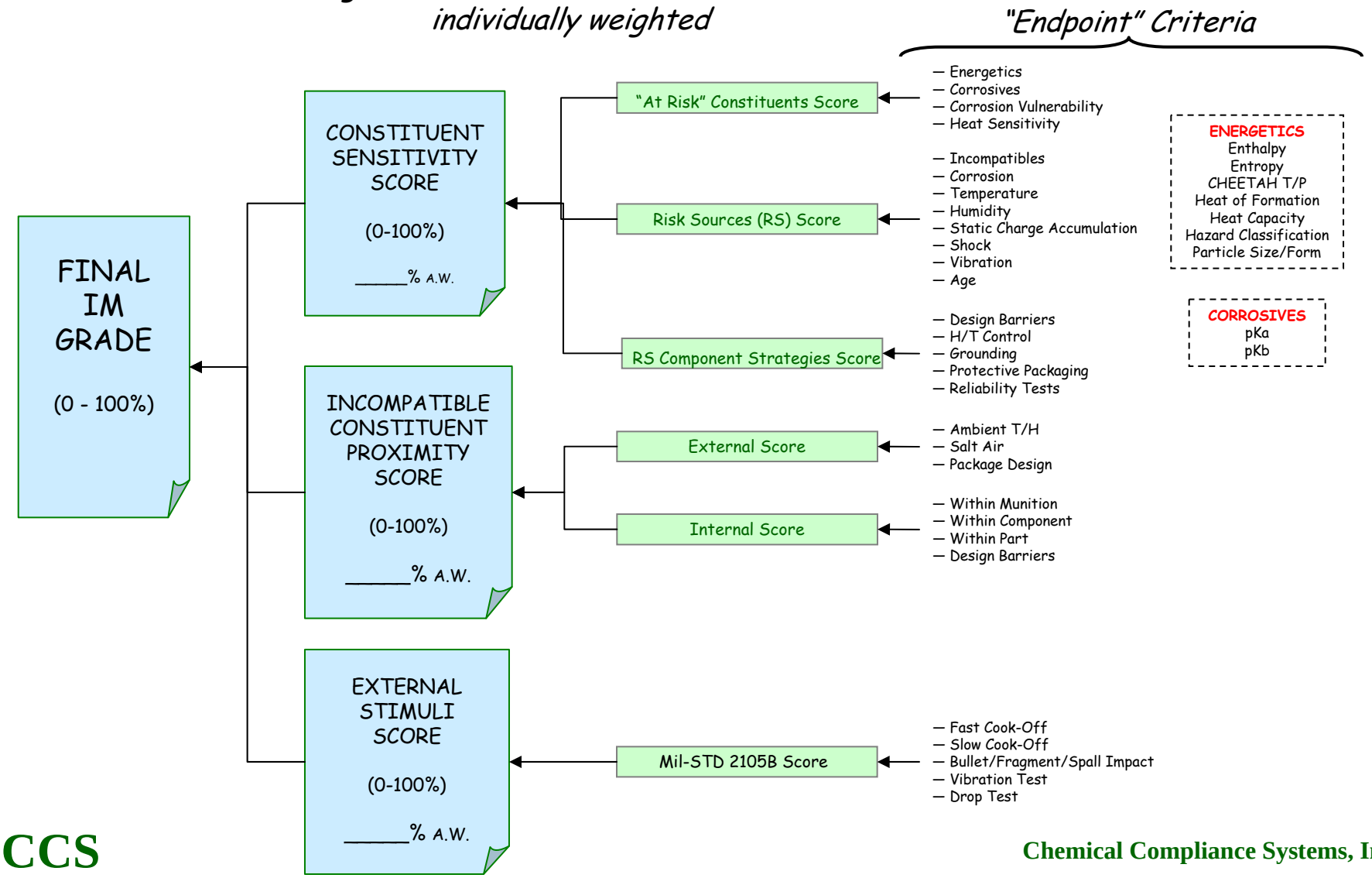
Thermal Couple Readings @:	2 • I TC1	TC2	TC3	TC4	Bore Pressure
2s					
4s					
6s					
8s					
10s					
12s					
14s					
16s					
18s					
20s					
22s					
24s					
26s					
28s					
30s					

System Components

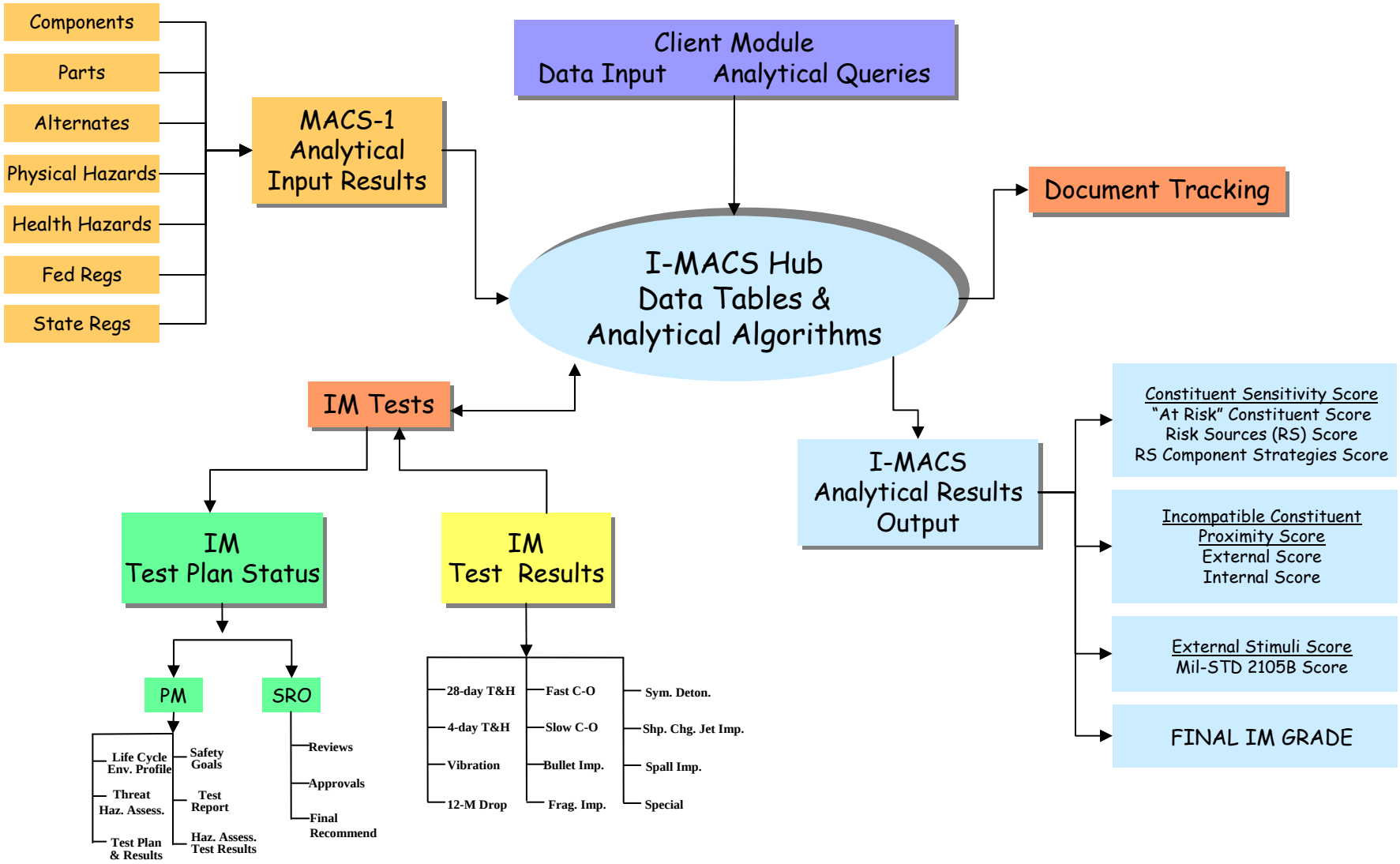


I–MACS Report Card & Scoring Scheme

Significance of each sub-score can be individually weighted



Data Acquisition & Analytical Report Capabilities



Insensitive Munitions Analytical Compliance System
(I-MACS)

For more information on I-MACS, or a remote demonstration of other MACS modules, please contact . . .

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