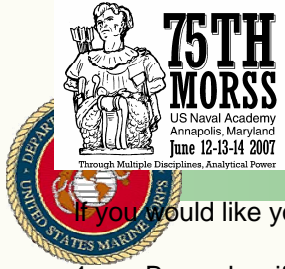


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12-14 June 2007, at US Naval Academy, Annapolis, MD



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Original title on 712 A/B: \_\_\_\_\_ MAGTF Fires Model \_\_\_\_\_

**(Please use the same title listed on MORSS Form 712 A/B. If the title was changed please list the revised title below.)** Revised title:

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Presented in: WG(s) #\_12, 13, 29\_\_\_\_, CG \_\_\_na\_\_\_\_\_, Special Session \_\_\_na\_\_\_\_\_

Demonstration, \_\_\_\_\_na\_\_\_\_\_, Tutorial, \_\_\_\_\_na\_\_\_\_\_ or Focus Session # \_\_\_na\_\_\_\_\_

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# MAGTF Fires Model

## focusing on Kinetic Fires

**LtCol. John Bruggeman, USMC**

**Mr. Kevin Hankins**

**Maj. Chris Michel, USMC**

**Mr. Mike Bovan**

**Analysis Branch**

**Operations Analysis Division, MCCDC**

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# Definitions/Scope



- **The Marine Air-Ground Task Force (MAGTF) is the USMC' principle organization for the conduct of all missions across the range of military operations.**
- **Kinetic fires exercised with this Modeling tool are: mortars, bombs, missiles, rockets, and guns.  
This tool does not simulate: electronic warfare, energy weapons, or information operations.**
- **This tool is an executable Microsoft Excel VBA file that others can apply to similar questions.**

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# Purpose of this Presentation



The purpose of this Presentation is:

- To share this methodology with you so that you can choose the appropriate tool for your problem set. This could save you months of effort, and influence programmatic decisions that ultimately save lives on the battlefield.
- To obtain your feedback.

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# MAGTF Fires Model Overview



- This tool models any size scenario. Both set-up time and simulation time are relatively fast.
  - Approximately 24-hour duration frames of a MEF-size MCO scenario may be simulated in 12 minutes (120:1) on a standard Windows PC.
  - The entire simulation may be set up in less than one person-month.
  - Excursions (experimental changes to the baseline) may be set up in minutes.
  - The Model is fully supported by one civilian.
- This has provided insight into USMC Fires Capabilities.

MEF = Marine Expeditionary Force  
(~50,000 Marines and Sailors)

MCO = Major Combat Operations

# Example of a recent success



- New questions for a MEF-size MCO scenario:
  - A question was raised concerning # of JSF Sorties per day.
  - A question was raised concerning aerial refueling.
- Mr. Bovan developed excursions, ran the Model many times, and analyzed the results to address both questions, all within one week.
  - # Sorties per day was changed using the Firing Platforms input list Sheet.
  - Aerial refueling was simulated by adding range to the aviation Firing Platforms.
- This illustrates the rapid M&S capability of this Model.

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# MAGTF Fires Model Agenda



- **What type of questions does this Model answer?**
- **Model Description and Methodology**
- **How to provide Model Inputs**
- **Model Outputs**
- **Issues / Concerns**

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# MAGTF Fires Model Agenda



- **What type of questions does this Model answer?**
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# “Key Questions”



## 1. Are USMC fires systems capable of generating all desired effects?

Key concerns are:

- Platform and munition range
- Aircraft movement
- SEAD prerequisite targets
- Precision weapons
- Inclement weather
- Area targets / Volume fires
- Restricted Rules of Engagement
- Moving Targets
- Armored Targets
- Consider the impact of the changes to procurement timelines of “at risk” systems.

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# “Key Questions”



2. What are the programmatic decisions that can mitigate shortfalls in platforms and munitions?
3. How dependent is the Marine Corps on Naval/Joint fires?

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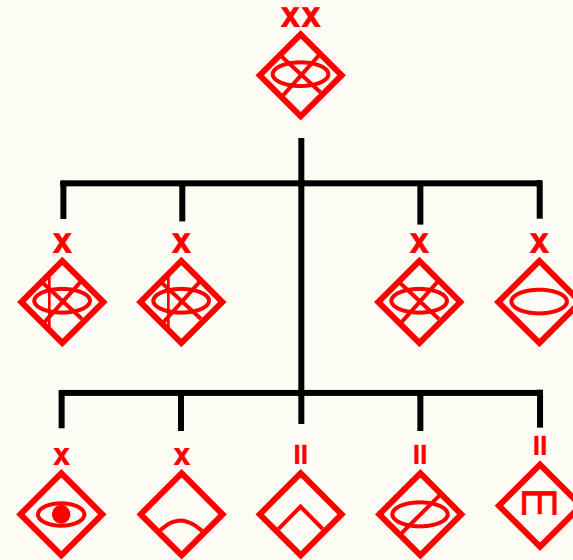
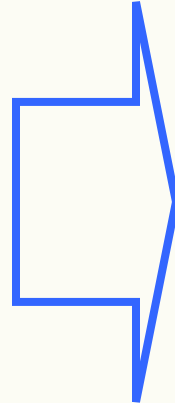
# “Is the pile of shooters big enough for the pile of targets?”



Fire Support Platforms in 2024 MEF
81 mm mortar
EFSS 120mm mortar
M777 155mm Lightweight Howitzer
HIMARS
DDG 51: (5" Conventional Only)
DDG 51 Flt IIA: (ERM capable)
DDG 1000. (LRLAP capable)
AH-1Z
UH-1Y
JSF



Ammunition available to the MEF
HE: 81mm, 120mm, 155mm, 5"54
Excalibur
DPICM
M26, GMLRS
ERM
LRLAP
Hellfire
Rockets
25mm
Maverick
DMLGB
SDB
JDAM (500, 1000, 2000 lbs)
JSOW



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# MAGTF Fires Model Agenda



- What type of questions does this Model answer?
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# MAGTF Fires Model Description



- The MAGTF Fires Model is a deterministic assignment model. It includes stochastic variables for availability of firing platforms, and effect on cluster targets.
- It takes the given targets, firing platforms, and munition counts as inputs, then applies them according to all the constraints in a timeless sequence for a limited portion of a fire-fight (analyst-defined, usually ~24 hours).
- This is a Microsoft Excel workbook with VBA automation.
- This tool usually determines minimum capability gaps due to the following assumptions:



# MAGTF Fires Model Assumptions



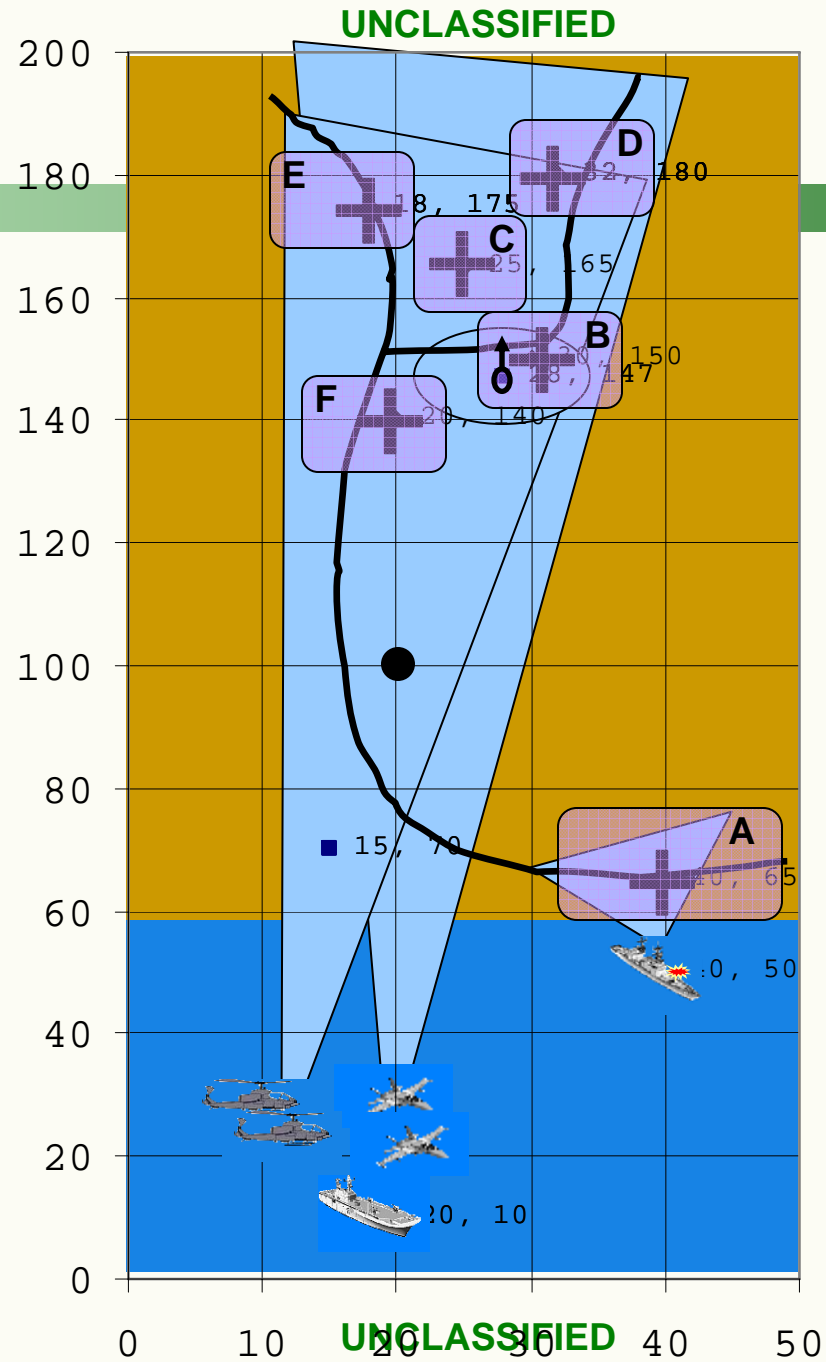
- **ISR is assumed perfect**
  - Target observation/identification is not explicitly modeled.
- **Perfect Command/Control/Coordination**
  - Firing info is available to firing units, coordination is assumed.
- **No Blue Force attrition inside the model**
  - Begin with T/O and T/E for the chosen scenario.
  - Blue firing platforms availability is user input, stochastic
- **Logistics**
  - Munitions count is limited to the quantity available during the chosen time period (~24 hours) and platform constraints
- **JMEM/JWS data is assumed accurate**
  - No line-of-sight, Ph, or Pk calculations

# Overall Modeling Approach



- Determine systems for inclusion and availability during specific years of interest.
- Develop scenarios and tables.
- Perform initial evaluation of each scenario.
  - Phased assessment of fires capacity
  - Assignment Algorithm of Fires resources to targets by Priority\*\*
- Perform analytic excursions.
- Explore results for insights, gaps, and potential fills.

\*\* The Intention is not to predict the outcome of the scenario, but to characterize the fires engagements that are *reasonably likely* during a particular scenario and assess our ability to accomplish USMC fires goals with the assets available and relative to other, potential, inventories.



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# MAGTF Fires Model Agenda



- What type of questions does this Model answer?
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# Overall Work Breakdown



Done by the Analyst:

- \* Choose warfare date and scenario.
  - \* Choose Duration of each Model Run.
  - \* Obtain data.
  - \* Enter input tables.
  - \* Run the Model (Press Reset and Run buttons).

Done by the Model:

- \* For each Target by Priority
  - \* Determine Munition by Preference and constraints
    - \* Determine 1 or more Platforms by constraints
    - \* Make assignments.
      - \* If Area-Munition and Cluster-Target, apply area effect.
  - \* If desired effect is not achievable, try lesser effect.

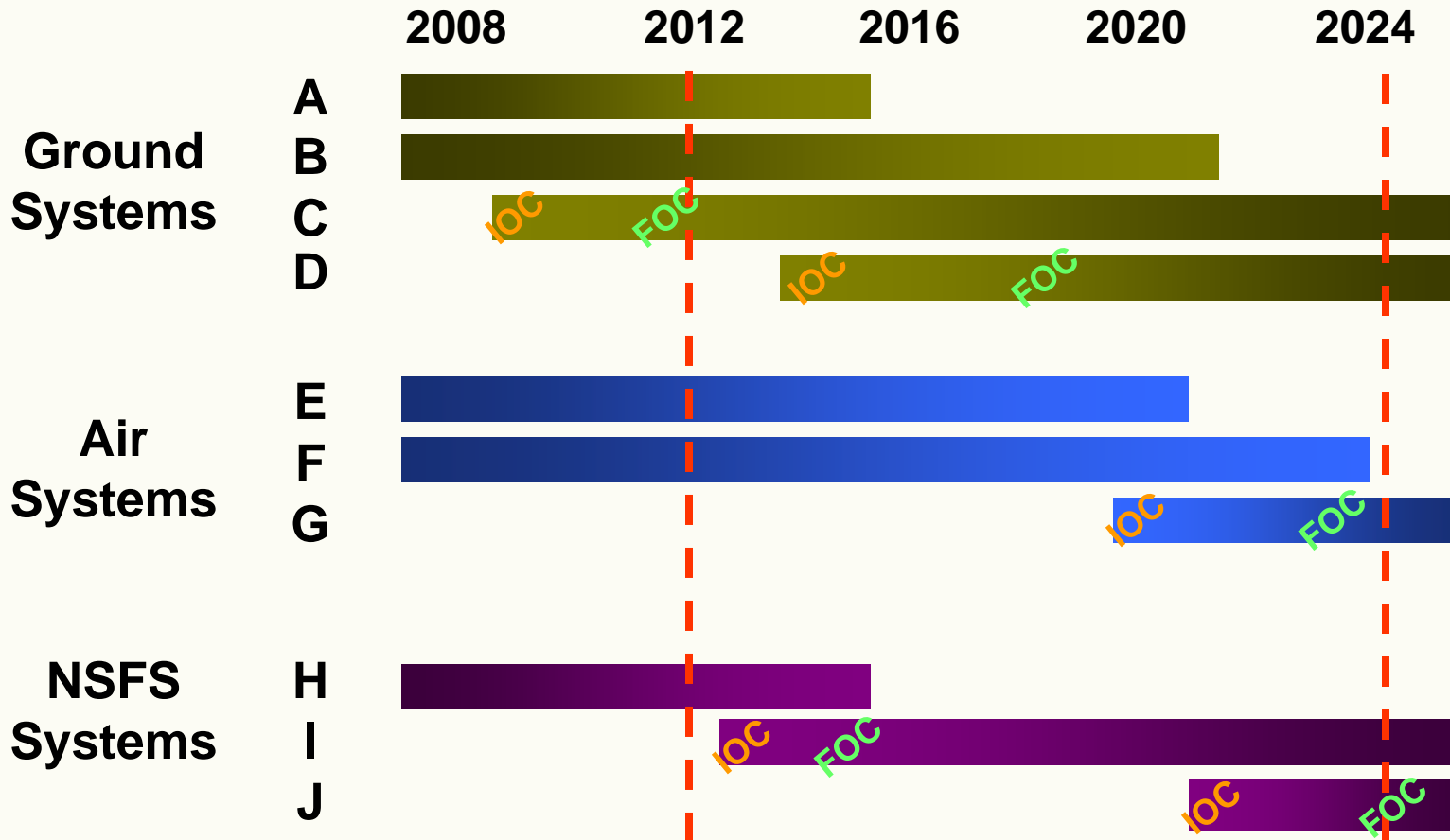
# Example of Included Systems



<b>Ground:</b>	EFSS 120mm Mortar
	M777 155mm Howitzer
	HIMARS
<b>NSFS:</b>	5"/54
	5"/62 (ERM)
	AGS (LRLAP)
<b>Aviation:</b>	AH-1W
	UH-1N, UH-1Y
	AV-8B
	F/A-18
	JSF

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# Identify System Availability



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# MAGTF Fires Model Inputs Regions



- The analyst enters any number of regions.

Region	Adverse Weather	Restrictive Environment
A	FALSE	FALSE
B	FALSE	TRUE
C	FALSE	FALSE
D	FALSE	FALSE
E	FALSE	FALSE
F	TRUE	FALSE
G	FALSE	FALSE
H	FALSE	FALSE

Input Guide	
Environmental	
Operational	
Technical	

- A region can be any size. Every target must be included in a region.
- Targets in "Adverse Weather" regions may only be engaged with "All-Weather" munitions.
- Targets in "Restrictive Environment" regions may only be engaged with munitions that are designated as "Precision" and "Limited ECR".

ECR = Effective Casualty Radius

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# MAGTF Fires Model Inputs Targets



- The analyst enters any number of targets.

Designator	Cluster	SEAD		Description	Region	X-Location	Y-Location	Mobility	Effect	Pri
		PreReq	Type							
1010	N/A	N/A	D	building	B	30	150	S	S	1
1050	N/A	N/A	E	mortar site	F	20	140	R	N	2
1020	N/A	N/A	D	building	C	25	165	S	N	3
1030	A	N/A	B	armored veh	D	18	175	M	D	4
1031	A	N/A	B	armored veh	D	18	175	M	D	5

- A target may be a single item of equipment or a collection of any number of items or units.
- SEAD prerequisite targets will be assigned first.
- Mobility: S=Static, R=able to Relocate, M=Mobile; (R or M) targets in a cluster are not attacked by subsequent sorties of the same aircraft.
- Effect desired may be: D=Destroy, N=Neutralize, S=Suppress

SEAD = suppression of enemy air defenses

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# MAGTF Fires Model Inputs Firing Platforms



- The analyst enters any number of firing platforms.

Designator	Description	X-Location	Y-Location	Range	DS Region(s)	All-weather	Availability	# of attacks	Aviation?	CP-X	CP-Y	Range
												"used" per attack
10	NSFS54	40	50	0	N/A	TRUE	0.9	50	FALSE			
20	AV8(2)_A_1	20	10	500	N/A	FALSE	0.8	1	TRUE	20	100	25
20	AV8(2)_A_2	20	10	500	N/A	FALSE	0.6	1	TRUE	20	100	25
30	AH1(2)_A_1	20	10	400	N/A	FALSE	0.7	1	TRUE	20	100	5
30	AH1(2)_A_2	20	10	400	N/A	FALSE	0.5	1	TRUE	20	100	5
40	EFSS(3)_A	28	147	0	N/A	TRUE	0.85	50	FALSE			
41	EFSS(3)_B	28	147	0	N/A	TRUE	0.85	50	FALSE			

- Any number of targets may be engaged per row.
  - Aircraft: Each row is one physical aircraft sortie. “# of attacks” is unused.
  - Non-Aircraft: Each row is one physical fire system.
- Availability = probability of platform being able to respond
- Only all-weather platforms can conduct attacks on targets in adverse weather regions

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# MAGTF Fires Model Inputs Munitions



- The analyst enters any number of munitions.

Designator	Description	Range	ROE Criteria			
			Precision	Limited ECR	All-Weather	Area Effect
1	120HE	7	FALSE	TRUE	TRUE	TRUE
2	5HE	23	FALSE	TRUE	TRUE	TRUE
3	20mm	1	FALSE	TRUE	TRUE	TRUE
4	Hellfire	8	TRUE	TRUE	FALSE	FALSE
5	TOW	4	TRUE	TRUE	FALSE	FALSE
6	25mm	1	FALSE	TRUE	TRUE	TRUE
7	JDAM	1	TRUE	TRUE	TRUE	TRUE
8	Maverick	27	TRUE	TRUE	FALSE	FALSE

- These tables are relational. Targets in "Restrictive Environment" regions may only be engaged with munitions that are designated as "Precision" and "Limited ECR".

ECR = Effective Casualty Radius

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# MAGTF Fires Model Inputs

## Platform-Munition Pairs



- The analyst enters total quantity of munitions available on each platform/sortie during the modeled time period.

Platforms		Munitions							
Desig	Descrip	1	2	3	4	5	6	7	8
		120HE	5HE	20mm	Hellfire	TOW	25mm	JDAM	Maverick
10	NSFS54		500						
20	AV8(2)_A_1						200	4	
20	AV8(2)_A_2						200	4	
30	AH1(2)_A_1			220	2				
30	AH1(2)_A_2			220	2				
40	EFSS(3)_A	50							
41	EFSS(3)_B	50							

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# MAGTF Fires Model Inputs Munition-Target Preferences



- The analyst enters the Attack Guidance Matrix.

		Munition	1	2	3	4	5	6	7	8
Target Type:			120HE	5HE	20mm	Hellfire	TOW	25mm	JDAM	Maverick
A	SAM site	Suppress	2	1	5			4	3	
		Neutralize	3	2	5		6	4	1	
		Destroy	5	4		3	4		1	2
B	armored veh	Suppress	2	1	5			4	3	
		Neutralize			5	1	3	4		2
		Destroy			5	1	3	4	6	2
C	light veh	Suppress	2	1	5			4	3	
		Neutralize	8	7	5	1	3	4	6	2
		Destroy			5	1	3	4		2
D	building	Suppress	3	2	5			4	1	
		Neutralize	3	2	5		6	4	1	
		Destroy	3	2		6	4		1	5
E	I/F site	Suppress	3	2	5			4	1	
		Neutralize	3	2	5			4	1	
		Destroy	3	2	5			4	1	
F	Personnel (sqd)	Suppress	2	1	4			3	5	
		Neutralize	2	1	4			3	5	
		Destroy	2	1	4			3	5	

- If a cell is left empty then that munition will not be employed against that target type.

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# MAGTF Fires Model Inputs

## Munition-Target Effects



- The analyst enters the Munitions Effectiveness.

Target Type:			120HE	5HE	20mm	Hellfire	TOW	25mm	JDAM	Maverick
A	SAM site	Suppress	20	20	300	2	2	300	3	2
		Neutralize	40	40	1,200	3	3	1,200	4	3
		Destroy	70	70	1,000,000	5	5	1,000,000	6	5
B	armored veh	Suppress	2	2	160	1	1	120	1	1
		Neutralize	10	10	240	1	1	200	3	1
		Destroy	25	25	320	1	2	280	10	1
C	light veh	Suppress	2	2	100	1	1	80	1	1
		Neutralize	4	4	180	1	1	150	2	1
		Destroy	8	8	250	1	2	220	5	1
D	building	Suppress	20	20	300	2	2	300	4	2
		Neutralize	40	40	1,200	5	5	1,200	6	5
		Destroy	70	70	1,000,000	10	10	1,000,000	14	10
E	I/F site	Suppress	15	12	150	2	2	125	2	2
		Neutralize	30	26	250	4	4	225	3	4
		Destroy	45	42	500	6	6	400	4	6
F	Personnel (sqd)	Suppress	4	3	250	2	2	200	1	2
		Neutralize	6	5	400	4	4	350	3	4
		Destroy	10	8	800	6	6	700	4	6

- This is how many are needed for the desired effect. This may be derived from the JMEM / Joint Weaponneering System.

\* Numbers here are notional.

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# MAGTF Fires Model Agenda



- What type of questions does this Model answer?
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# MAGTF Fires Model Runs: Main Output Table



“Turn the crank”: Now that the input Tables are complete, the analyst runs the Model (built-in Excel VBA software). The Model handles error checking along with all the logic.

- |                    |  |
|--------------------|--|
| Done by the Model: | <ul style="list-style-type: none"> <li>* For each Target by Priority                             <ul style="list-style-type: none"> <li>* Determine Munition by Preference and constraints</li> <li>* Determine 1 or more Platforms by constraints</li> <li>* Make assignments.                                     <ul style="list-style-type: none"> <li>* If Area-Munition and Cluster-Target, apply area effect.</li> </ul> </li> <li>* If desired effect is not achievable, try lesser effect.</li> </ul> </li> </ul> |
|--------------------|--|

All results are presented in a series of tables including this main table.

MAGTF Fires Model, Version 20070522. 5/31/2007												
Run #	Pri #	Tgt #	Tgt Desc	Desired Effect	Desired Effect Achieved?	Lesser Eff Achieved?	by Platform_1	w/ Munition	WX?	ROE?	Fail Reason	
1	1	1010	building	S	1	0	AV8(2)_A_1	JDAM	FALSE	TRUE	P#1M:JDAM-assigned	
1	2	1050	mortar site	N	0	0			TRUE	FALSE	P#1M:JDAM-P no-go, ammo;	
1	3	1020	building	N	0	1	AV8(2)_A_2	JDAM	FALSE	FALSE	P#1M:JDAM-P no-go, #ammo	
1	4	1030	armored veh	D	1	0	AH1(2)_A_1	Hellfire	FALSE	FALSE	P#1M:Hellfire-assigned	
1	5	1031	armored veh	D	1	0	AH1(2)_A_1	Hellfire	FALSE	FALSE	P#1M:Hellfire-assigned	

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# MAGTF Fires Model Agenda



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# MAGTF Fires Model

## Possible Improvements



- Munitions/platform cost; Optimization
- Change coordinate system from UTM (0-44km error per longitude zone) to WGS84 (0-1m error).
- Calibrated placement of covariance components in the Model
- Run joint, and unprogrammed, platforms and munitions
- Some blue force land/naval movement (affects availability)
- Greater understanding of JWS munition quantities
- Develop the minimum requirement for reduction in red forces during the ~24 hour duration of the Model.
- Locate/generate relevant scenarios data.

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# Questions?

# Feedback Welcome!

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**End of ppt**



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# Purpose of the Study



## **The primary objective is**

to determine if current and programmed fires capabilities of the USMC are sufficient to meet MAGTF operational requirements.

## **The secondary objective is**

to inform senior leadership on recommended courses of action for future capabilities development.

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## Results-in-Brief For MEF Fires in MCO



- **The Fires Triad (Air, Ground, Sea) is essential (if/when systems are removed, gaps are exacerbated)**
- **The use of metrics here are to gain insight not to advocate that some systems could/should replace others. To fully appreciate a systems utility its overall use must be taken into account.**
- **Experimental systems that are useful in OIF now will likely be useful in Irregular Warfare operations in the future ... if they are determined to be of value, efforts should be made to make them long term programs.**

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## Results-in-Brief For MEF Kinetic Fires in MCO



### Identified Joint Warfighting Gaps that Effect the Marine Corps

- **Fires Overall.** On average the MEF was only able to address ~58% of the targets in the AO.
- Inclement weather. Poor weather reduced MEF fires effectiveness from 60 to 56%
- **Area targets.** The MEF was less affective against area targets than against point targets. (52% and 83% respectively)
- Restrictive rules of engagement (ROE). The MEF was able to affect 54% of ROE targets compared to 66% of non-ROE targets.
- **Mobile targets.** The MEF was able to affect 66% of stationary targets but only 22% of mobile targets.
- **Armored targets.** The MEF was able to affect 72% of non-armored targets but only 28% of armored targets.

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# “Key Questions”



Are there any system redundancies or inventory quantities that represent a possible excess capacity?

If so, what are the implications on other systems and/or programs?

***Fires Capability***

**$\geq$**

***Number of targets***

**?**

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# Agenda



- **“Key Questions”**
- **Scope, Assumptions, and Limitations**
- **Methodology**
- **Scenario Set**
- **Analytical Results**
- **Issues and Timeline**

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# Scope



- Timeframe: 2008 – 2025  
Focus on 2014 and 2024
- Operational and Tactical Kinetic fires, to include:
  - Ground-to-ground
  - Air delivered
  - Naval surface fires
- MAGTFs sized from MEF(+) to MEU(SOC) and SPMAGTF
- Weather: Ideal and Adverse
- ROE/Operational environment:
  - Permissive or Restrictive
  - Scenario dependent

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# Study Assumptions



- The MAGTF remains the USMC's principal warfighting organization.
- Expeditionary Maneuver Warfare (EMW) and the family of warfighting concepts are the primary framework for the organization, deployment, employment, and sustainment of the future MAGTF, operating in a joint environment.
  - Will not specifically address DO.
- The Marine Corps maintains the capability to operate across the full spectrum of conflict.

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# Metrics

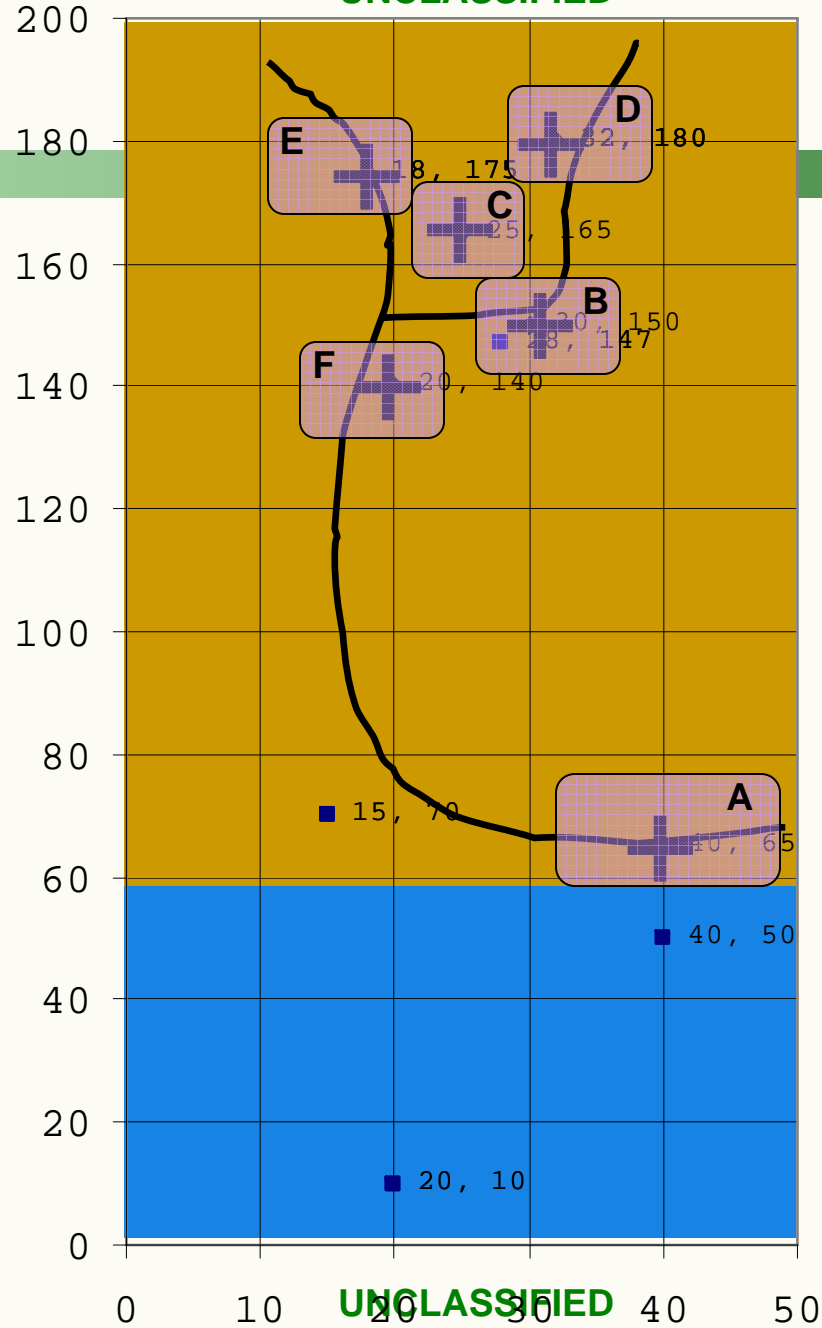


- % Targets Serviced
  - analyzed by various target characteristics (range, moving vs stationary, area vs point, etc)
- Ability to service “critical” targets
- Utilization of fires resources

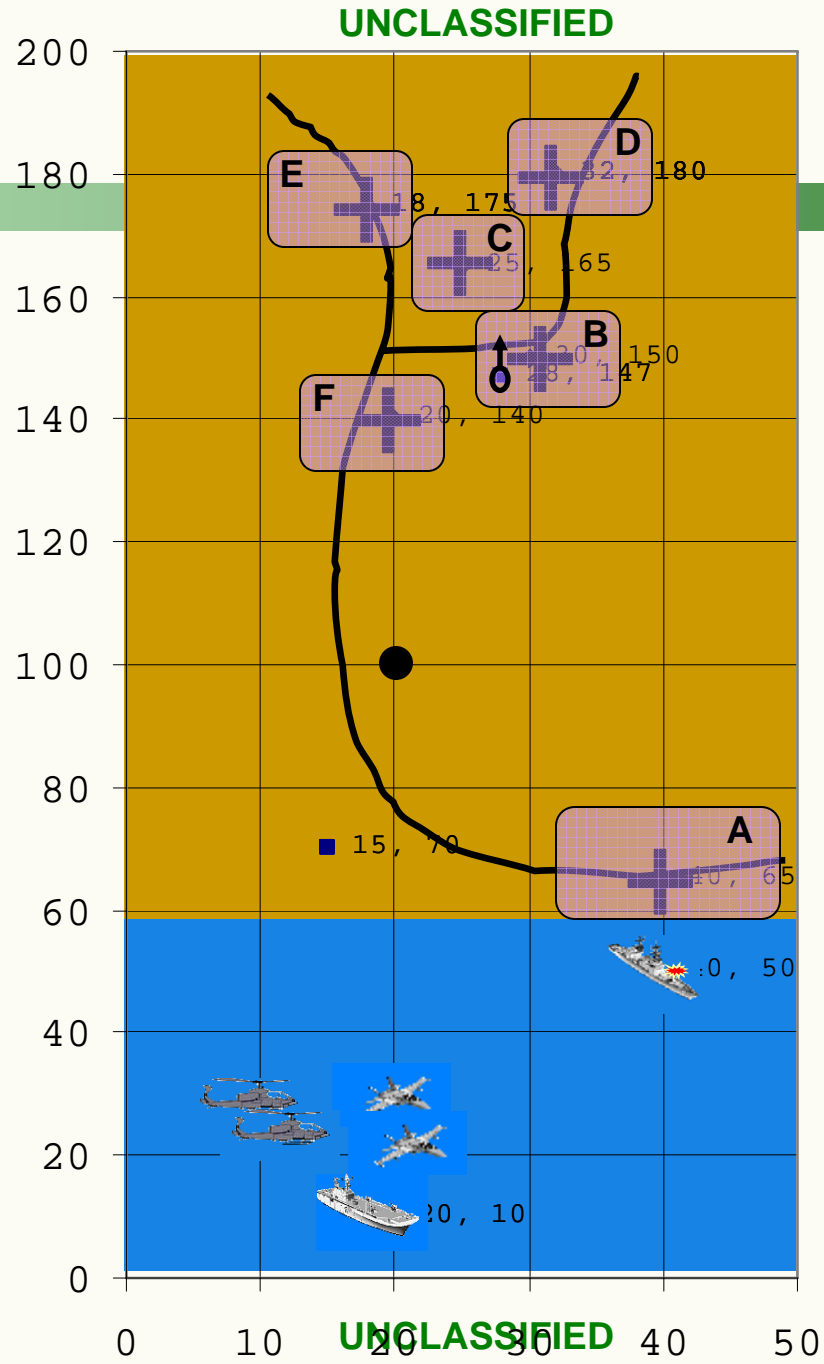
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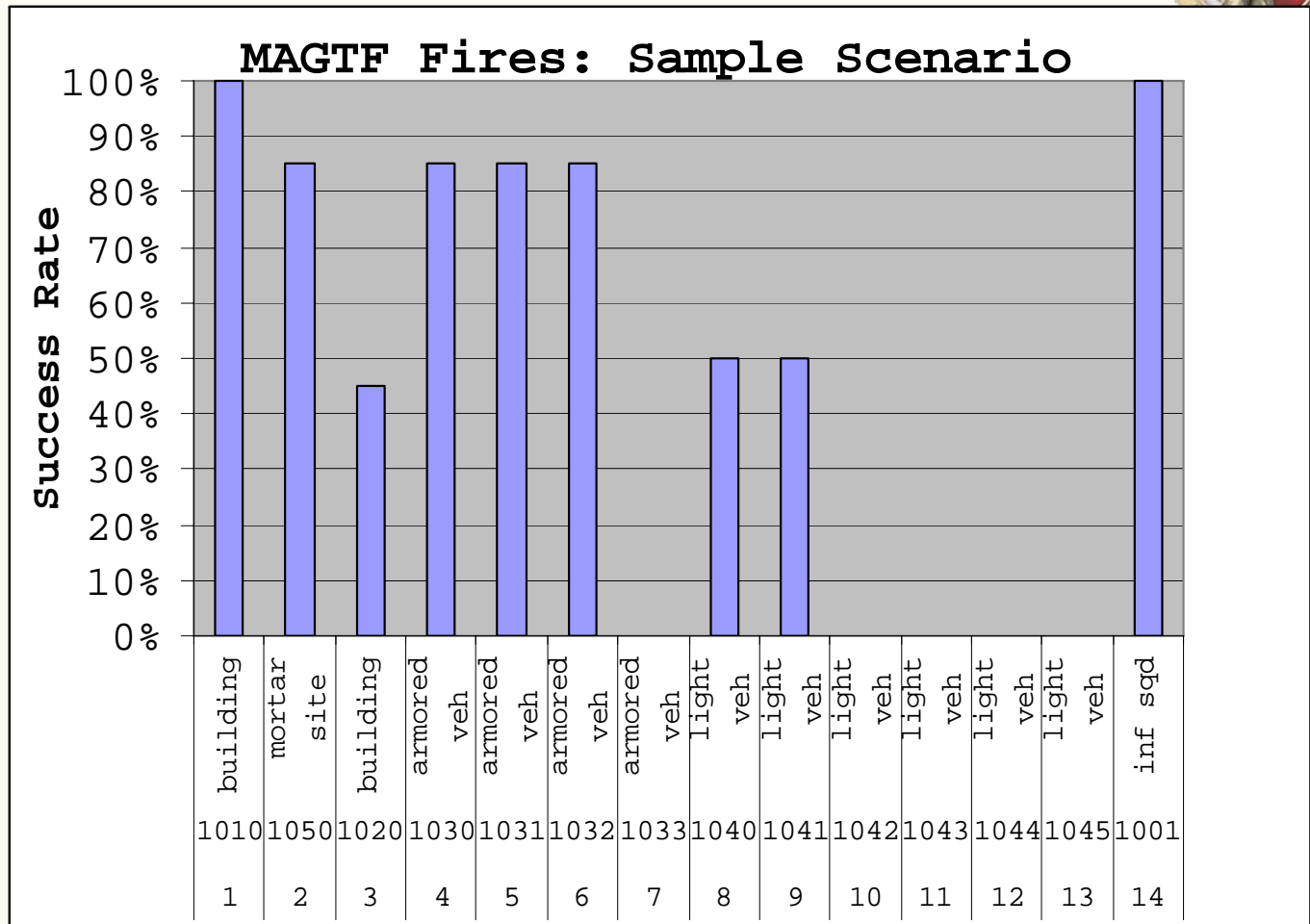
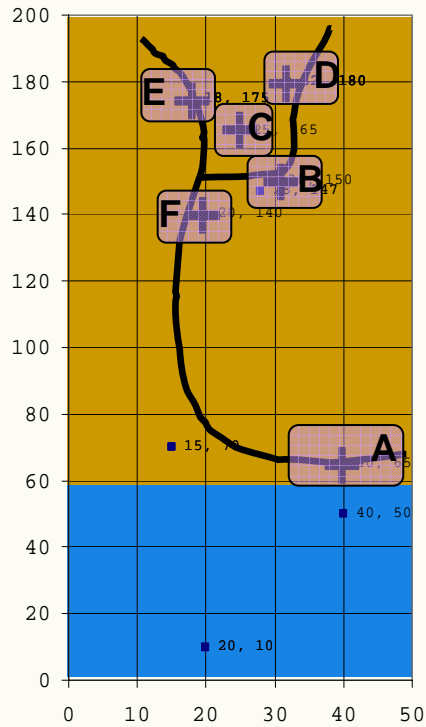
UNCLASSIFIED



Designator	Description
1001	inf sqd
1010	building
1020	building
1030	armored veh
1031	armored veh
1032	armored veh
1033	armored veh
1040	light veh
1041	light veh
1042	light veh
1043	light veh
1044	light veh
1045	light veh
1050	mortar site



# Sample Scenario: Baseline Results

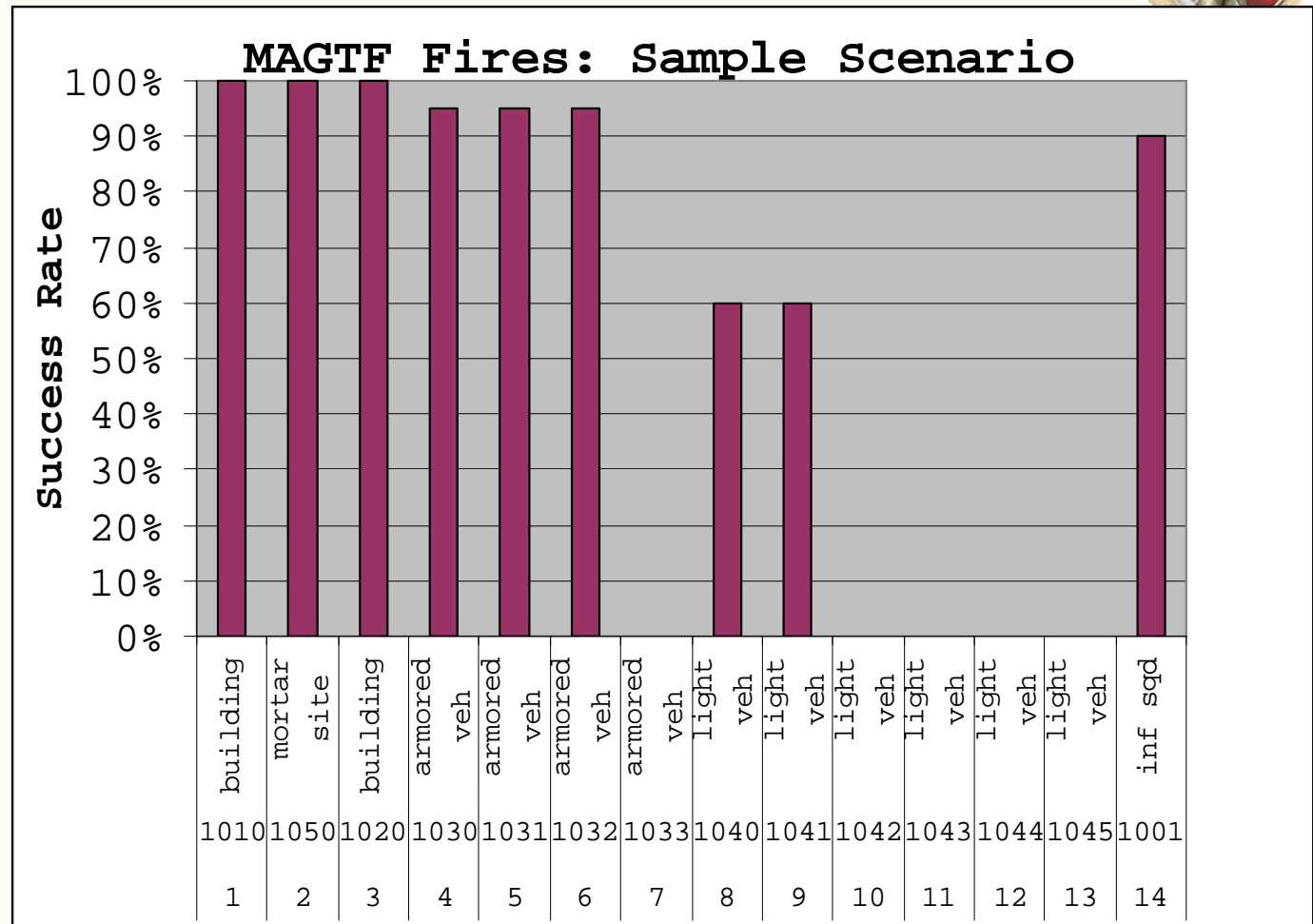
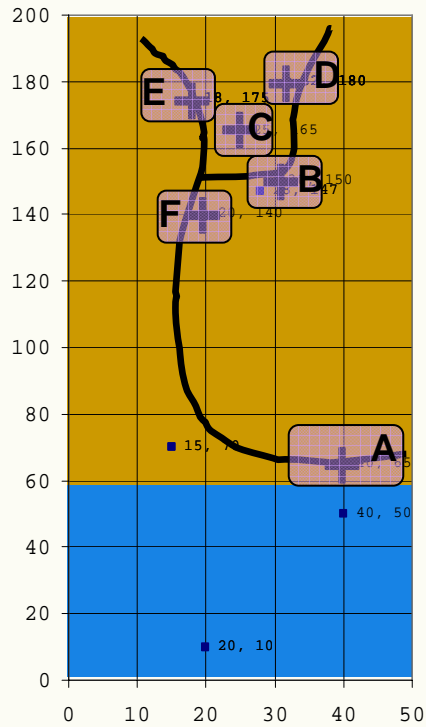


# Sample Scenario: PGMM



- Situation: same
- Mission: same
- Execution: changes:
  - Aviation situation same as baseline
  - EFSS has longer range, precision munition (HE)
  - Precision allows EFSS to be employed in urban region
  - Longer range (~3X) makes EFSS available for more targets, allows aviation assets to be used for true long range targets

# Sample Scenario: PGMM Results



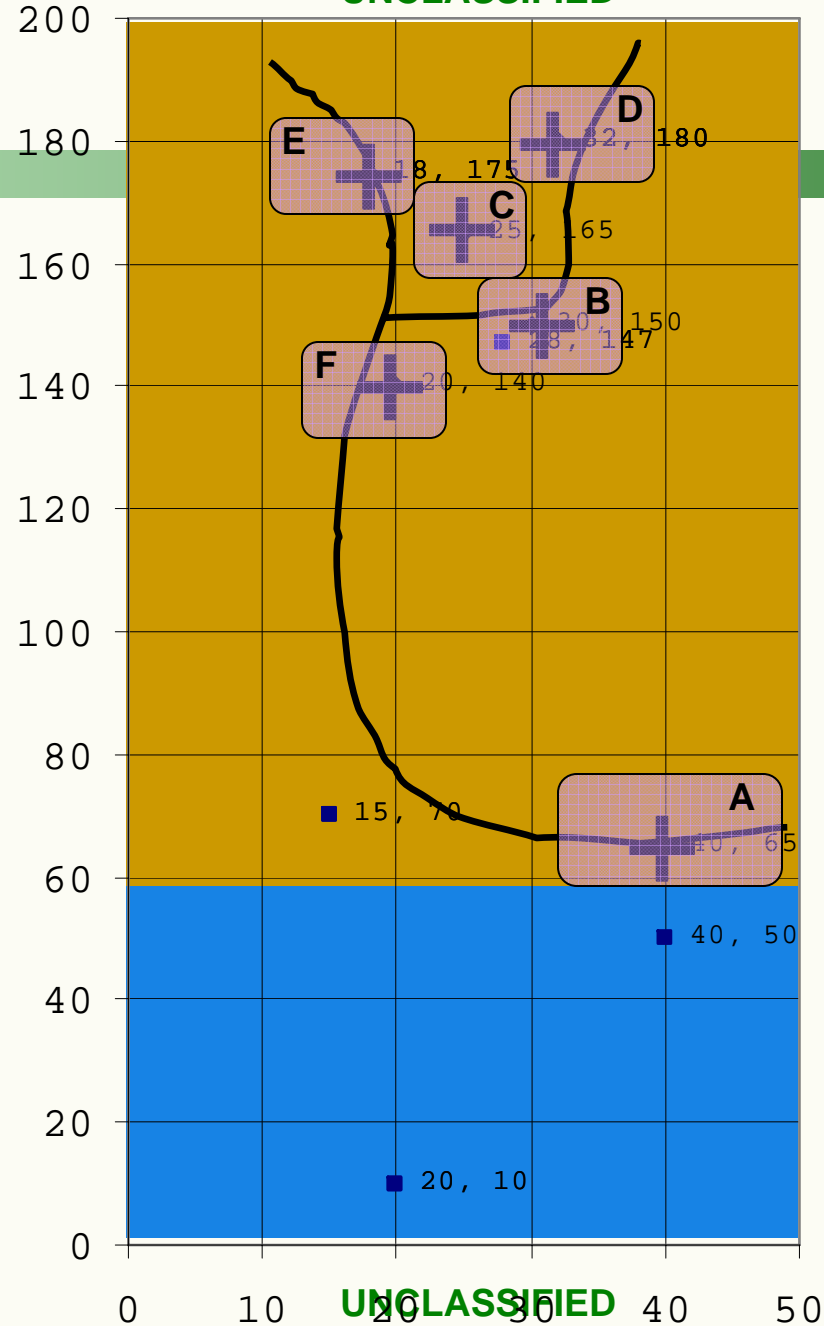
# Sample Scenario: FARP



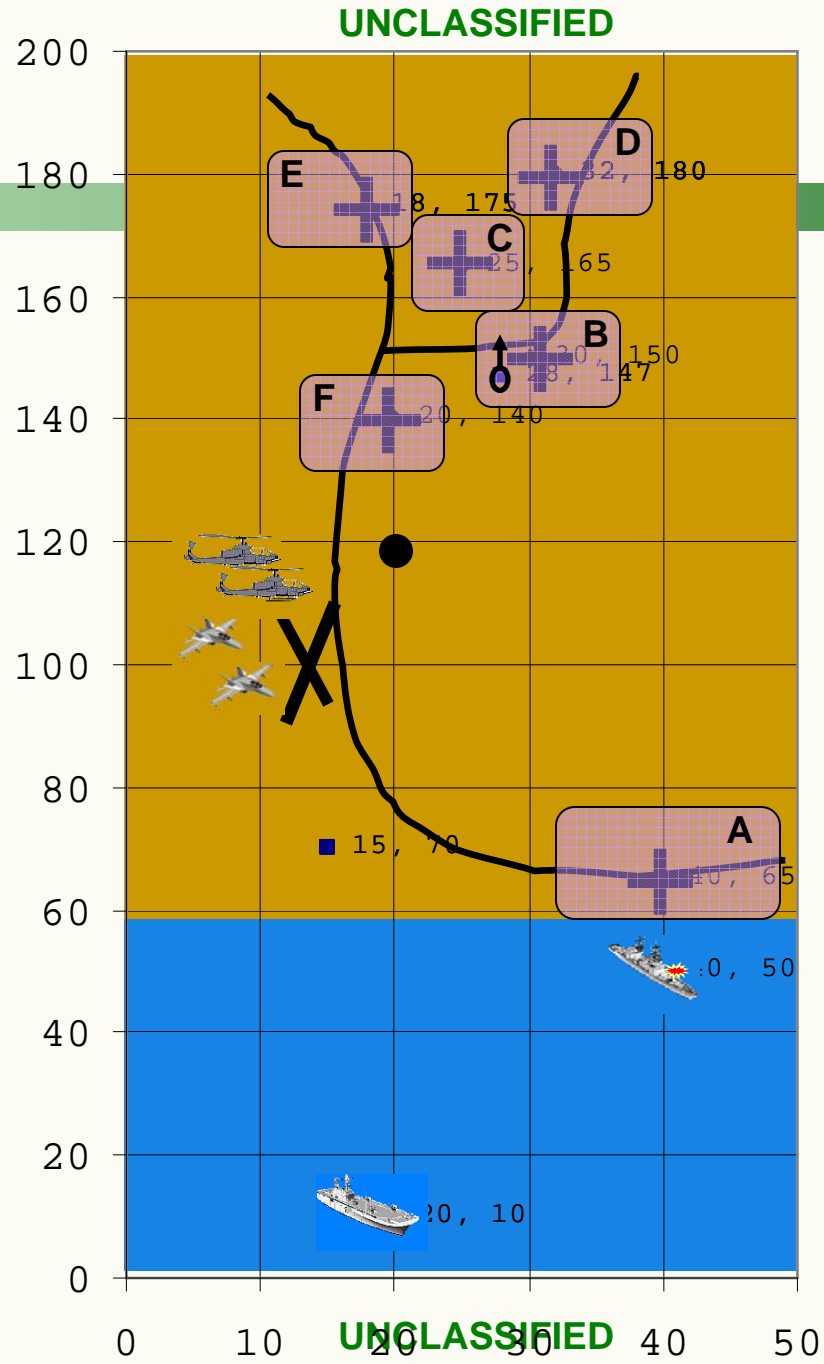
- Situation: same
- Mission: same
- Execution: changes:
  - FOB/FARP established ashore (~20 nm inland)
  - RW & FW operate out of FARP -> allows 3 sorties each
  - Closer origin results in less transit time -> increases availability (time on station)

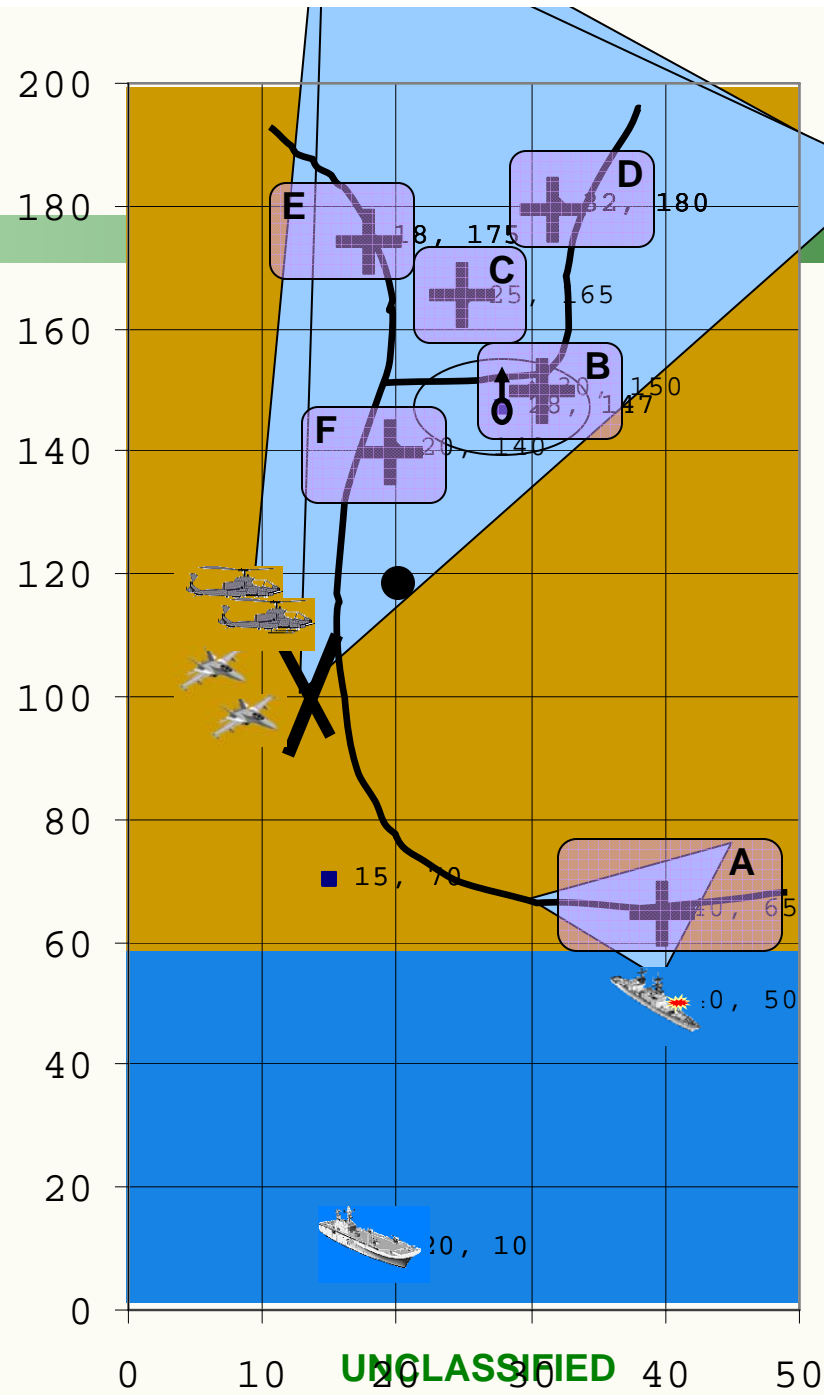


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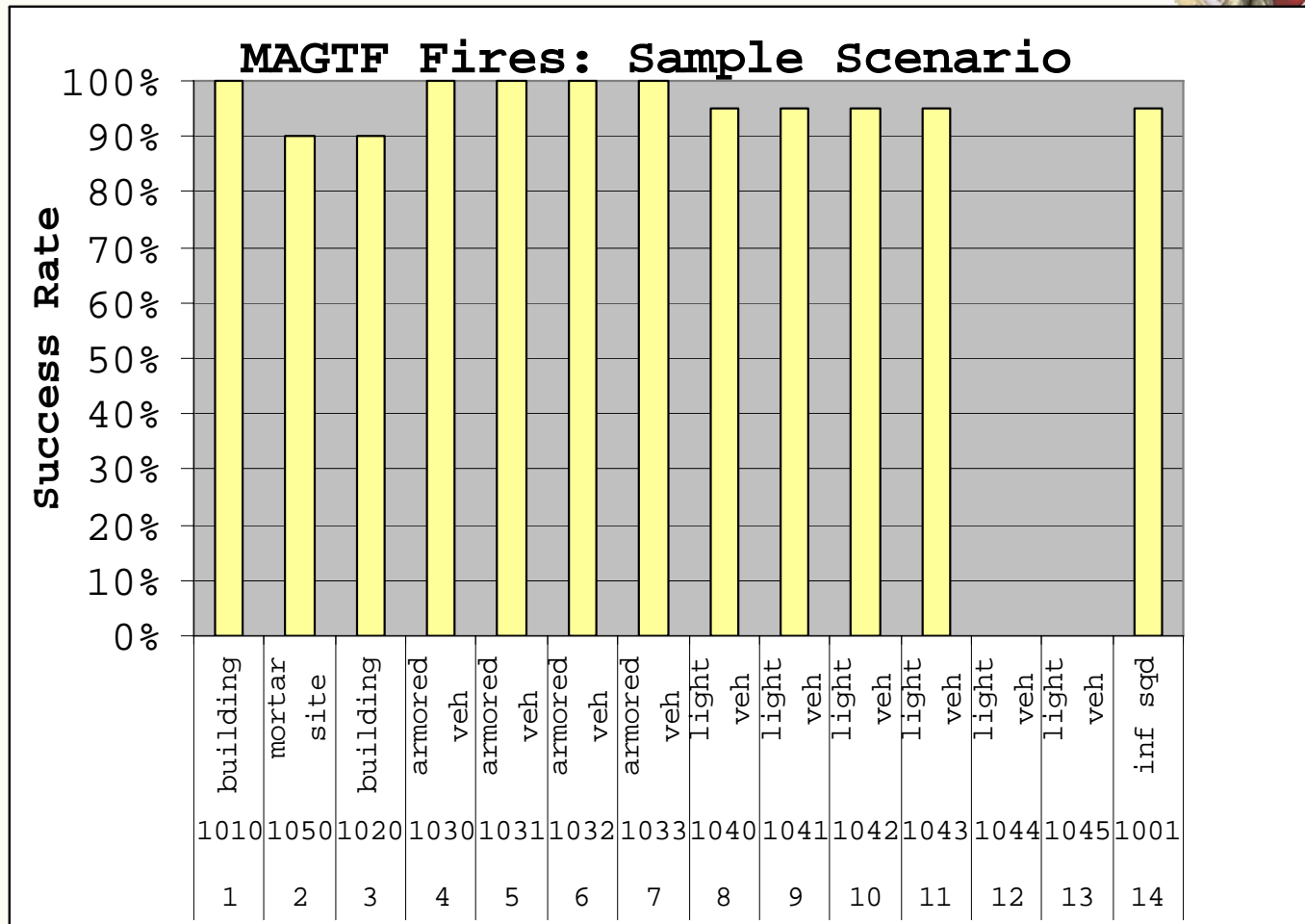
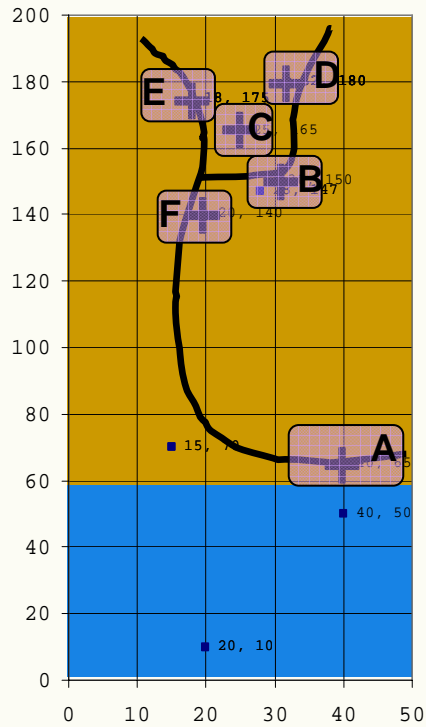


Designator	Description
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1043	light veh
1044	light veh
1045	light veh
1050	mortar site





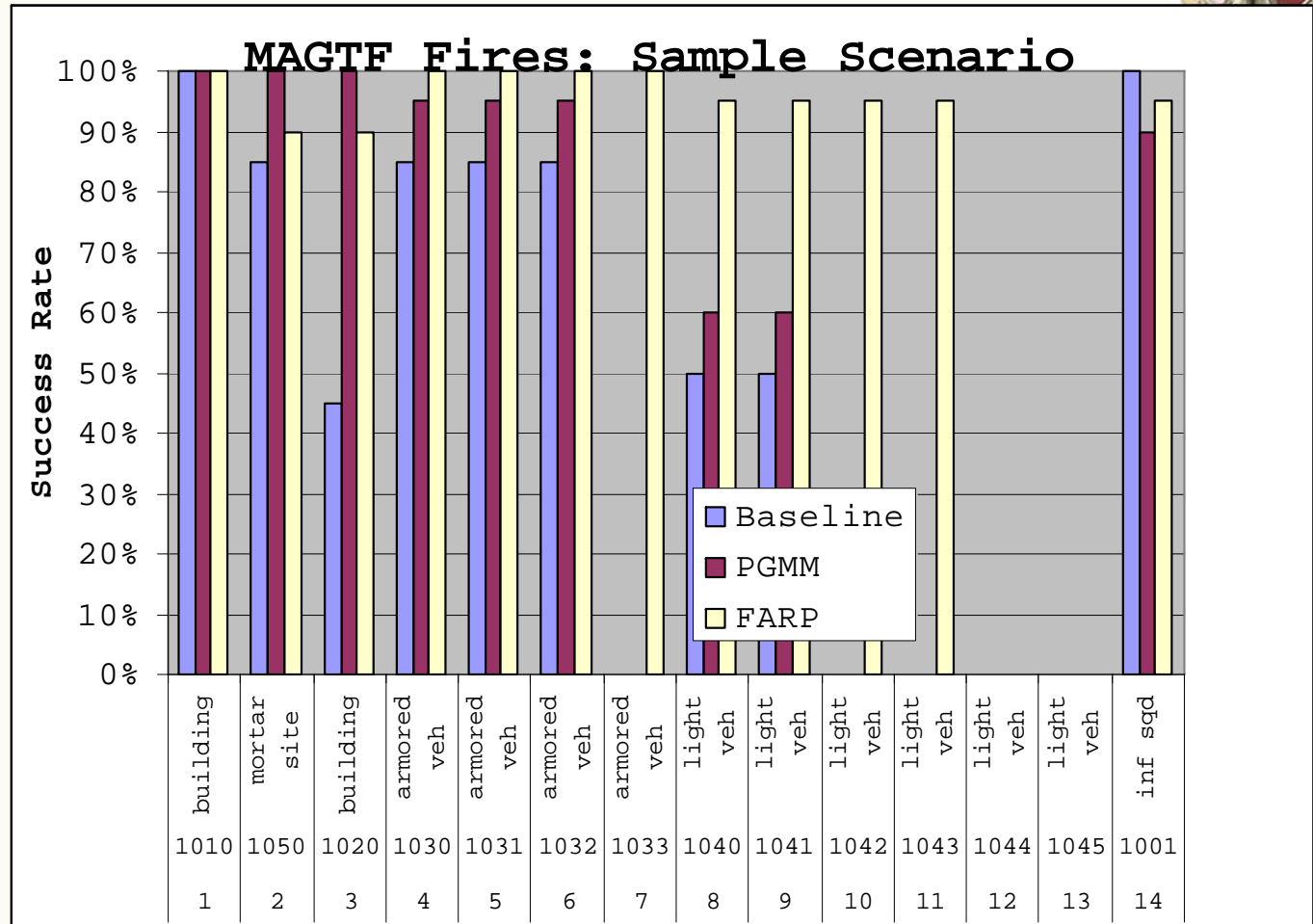
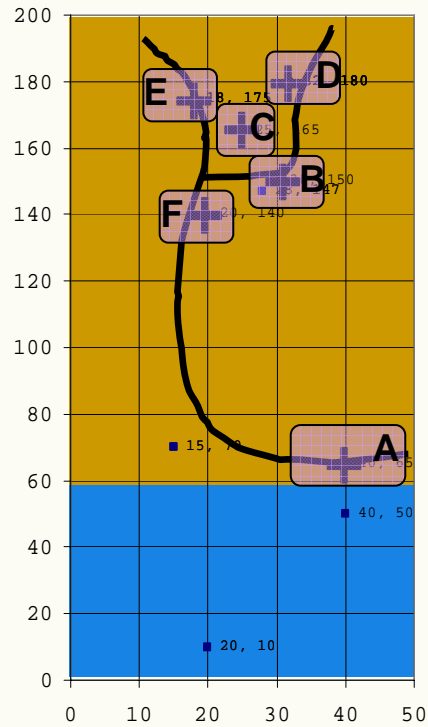
# Sample Scenario: FARP Results



# Sample Scenario: Comparison



Overall Success	
Baseline	48.93%
PGMM	56.79%
FARP	82.50%

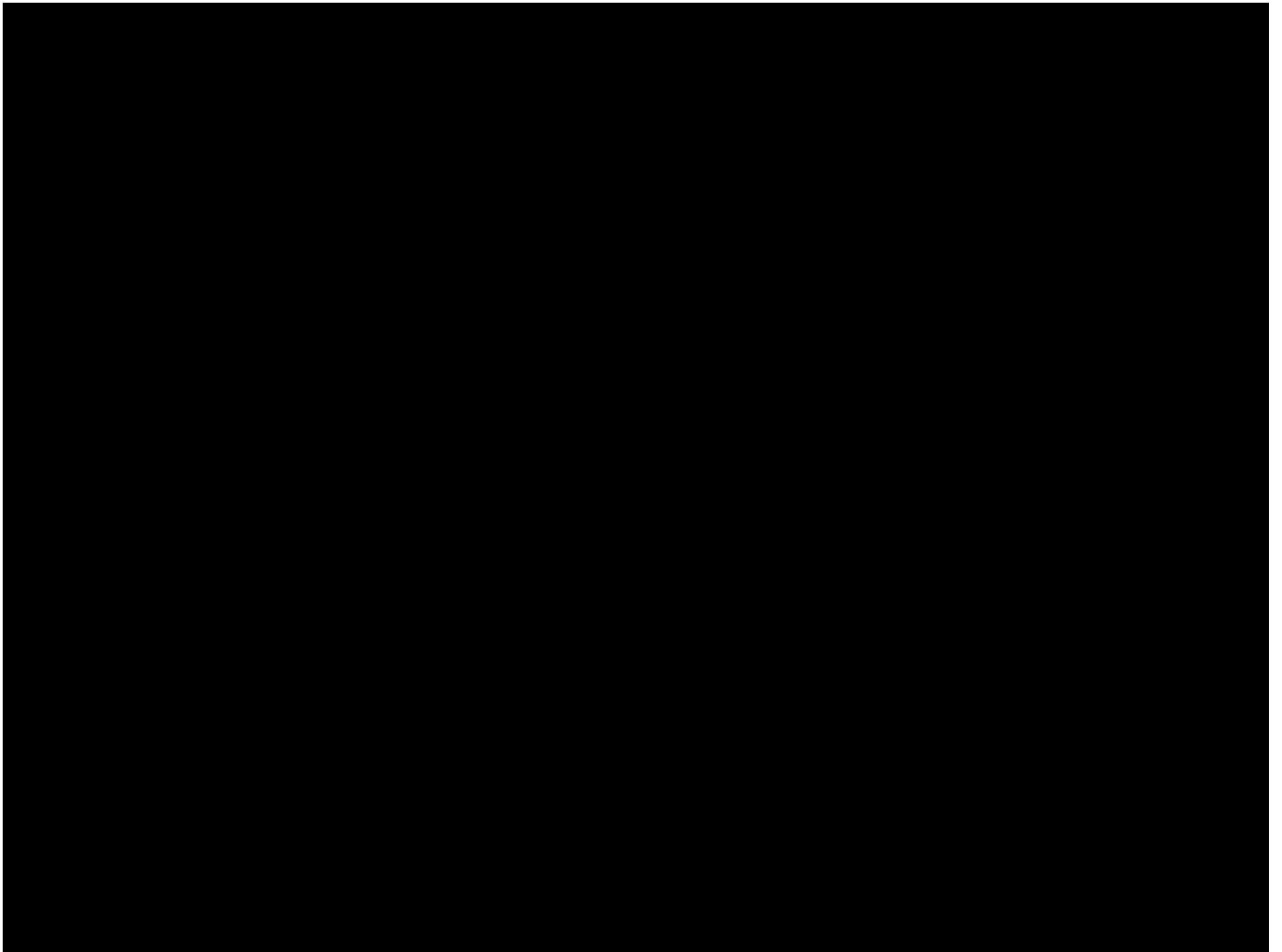


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# Questions?

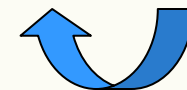
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# Set the Battlespace: Targets



- Not a schedule of fires, instead a list of all targets that might reasonably be engaged by friendly fires assets during this period of the operation.
  - Can be single entities to large units
  - Location specified by x,y coordinates
  - Must fall into a user-defined region
  - Identified as one of any number of user-defined target types (must be compatible with JMEM)
  - Must designate the effect desired (S/N/D)
  - Specified as mobile, able to relocate, or static
  - Priorities are assigned, 1 ... Total # of targets
  - Can be grouped into “clusters”
  - Can have other targets designated as pre-requisites (SEAD)

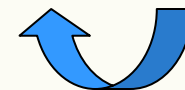




# Set the Battlespace: Fires Assets



- All friendly fires resources that can provide kinetic, tactical or operational level fires during this period.
  - Can be single entities to large units
  - Location given by x,y coordinates
  - Aviation platforms given an origin, CP, and max range
  - All-weather systems are identified
  - Availability = Prob that this asset will be available to respond when called
  - Assets can be designated as DS units
  - Munitions quantities carried by each asset
  - Ground systems may be limited by max # of engagements
  - Avn systems sorties all listed individually, # of attacks per sortie determined by munitions load and range



# Set the Battlespace

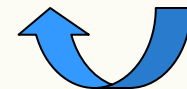


## ● Battlespace

- Regions are designated as ideal or adverse weather
  - ◆ Adverse WX = Optically guided munitions can not be employed
- Regions can be designated as “restrictive ROE”
  - ◆ Area demanding limited collateral damage
  - ◆ Close proximity to friendly forces
  - ◆ Other areas/targets requiring precision
  - ◆ Only precision-guided munitions will be employed

## ● Munitions

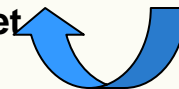
- Max range must be specified
- Characteristics include: all-weather, precision-capable, and area effects (as opposed to point effects)
- Munition preferences set for each target type, for each desired effect
- JMEM data used to determine quantity of munition (by type) required to achieve desired effect against each target type

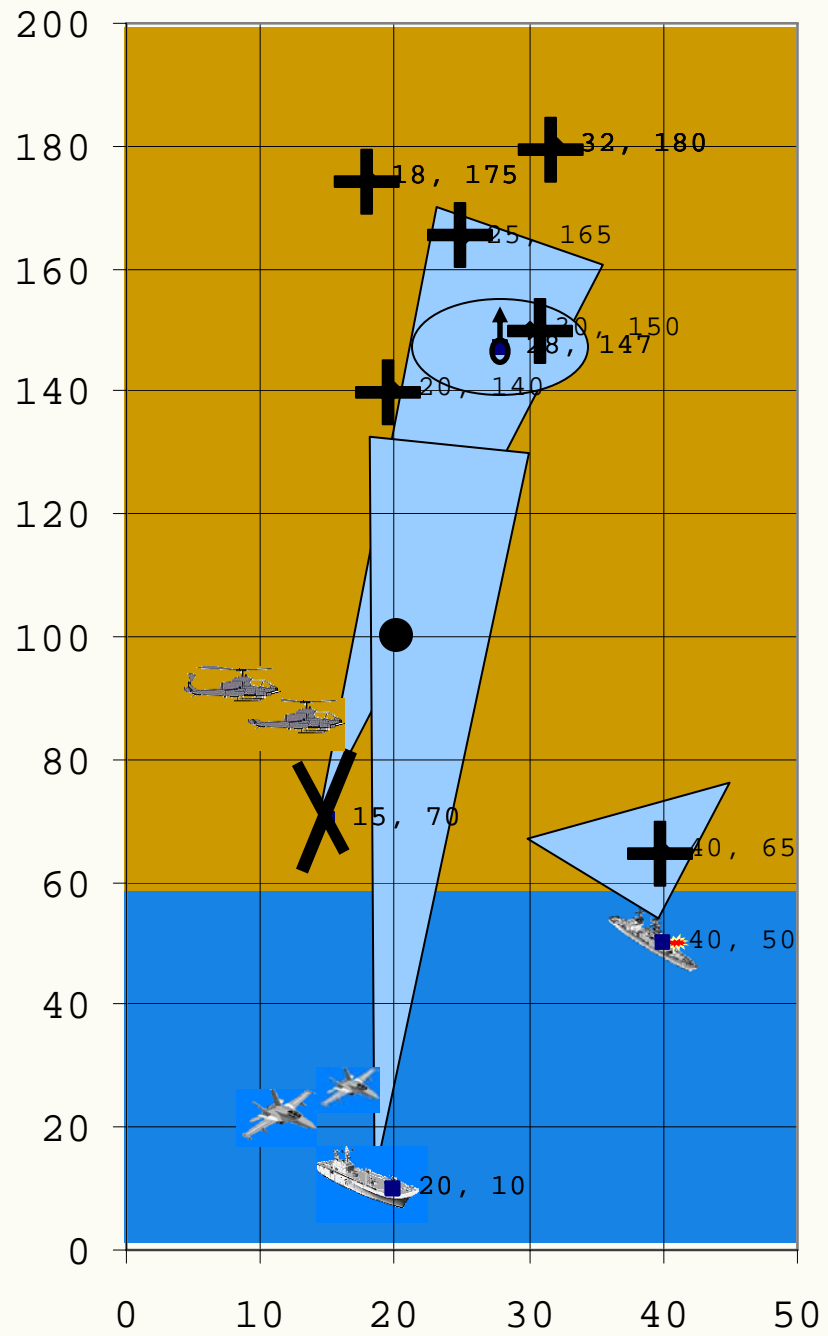


# Assignment Model



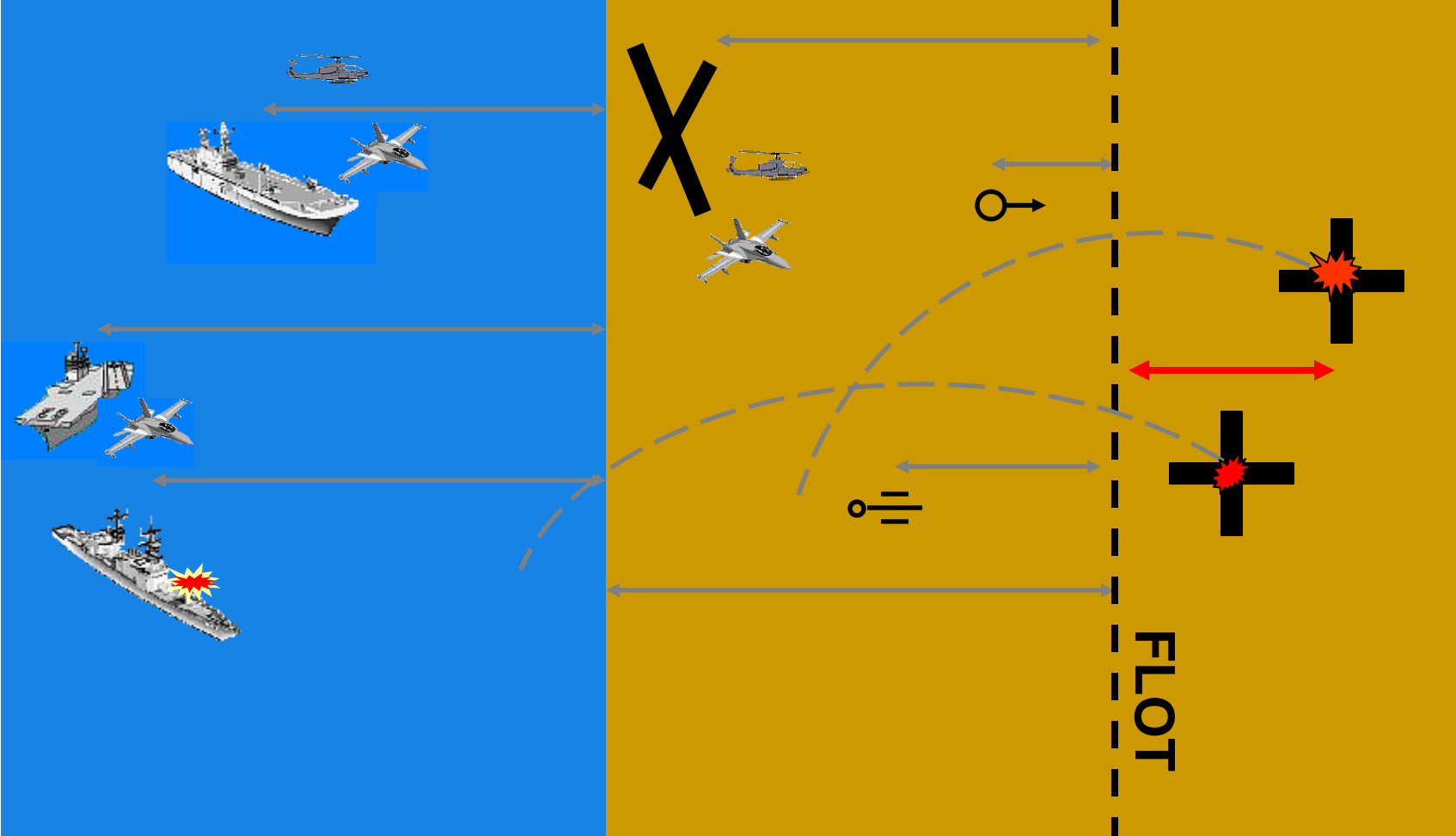
- Loops through targets in order of priority
  - Determine platforms available
    - ◆ Availability, # of attacks, DS assignment
    - ◆ All platforms available for lowest priority target in a cluster are available for all other targets in the cluster
    - ◆ If one sortie of an avn platform is assigned to attack a mobile/able to relocate target, then no other sortie of that platform will be available for that same target or others in that target's cluster
  - In order of preference, consider the munitions effective against the current target
    - ◆ Weather and/or ROE restrictions
    - ◆ From available platforms, consider only those employing this munition
    - ◆ Determine which of these platforms can range the target
  - Distance from point of origin to CP to launch point(s) back to CP then back to point of origin must not exceed max range
    - ◆ If the required quantity of munition is available (single platform or several together), **then assign the platform(s)/munition to this target**
    - ◆ Apply area effects to any other targets in the cluster





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# Range vs “Reach”



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# Limitations



- Includes systems that are not yet in production (capabilities are not well defined).
- Some future systems are “other service” and therefore employment and structure is not well defined.
- Scope is large – this study is designed to be a “wavetop” view to cover the broad landscape.
  - Won’t necessarily provide “actionable” details for any given scenario/timeframe/system.
  - Will provide recommendations and point out areas of concern requiring a closer look.

# Target & Fires Asset Data



- For each scenario
- For given period (operational phases, or shorter)

## Targets

- Location
- Priority
- Target type/effects desired
- Precision required
  - Restricted terrain / Collateral damage?
  - Moving?

## Fires Resources

- Location
- Range
- Lethality/effects
- Precision capable
- All-weather capable
- Capacity (availability, tactical employment, etc.)

# Basic Modeling Methodology



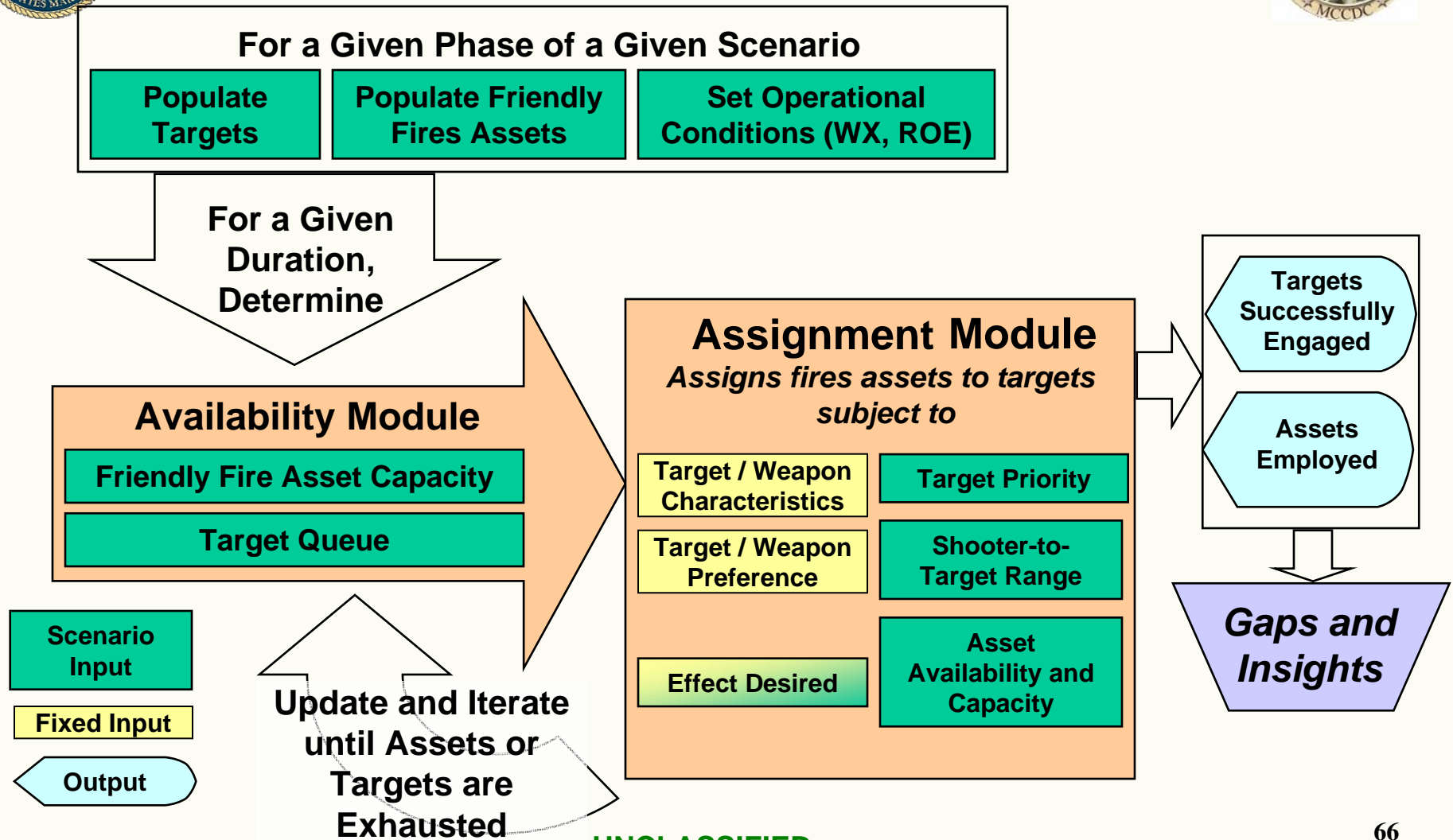
- Consider a discrete period of time during a given phase of an operation.
- Assignments – match capable fires assets to active targets.
  - Targets are not engaged on a schedule – instead engaged based on target priority guidance.
- Employ JMEM data to determine munition effectiveness vs the particular target type.
  - No line-of-sight or  $P_h, P_k$  calculations.
- Fires asset availability is not determined by a strict timeline or “script” but by a set of availability rules.
  - “Timeless” quality to assignments.

# Acronyms

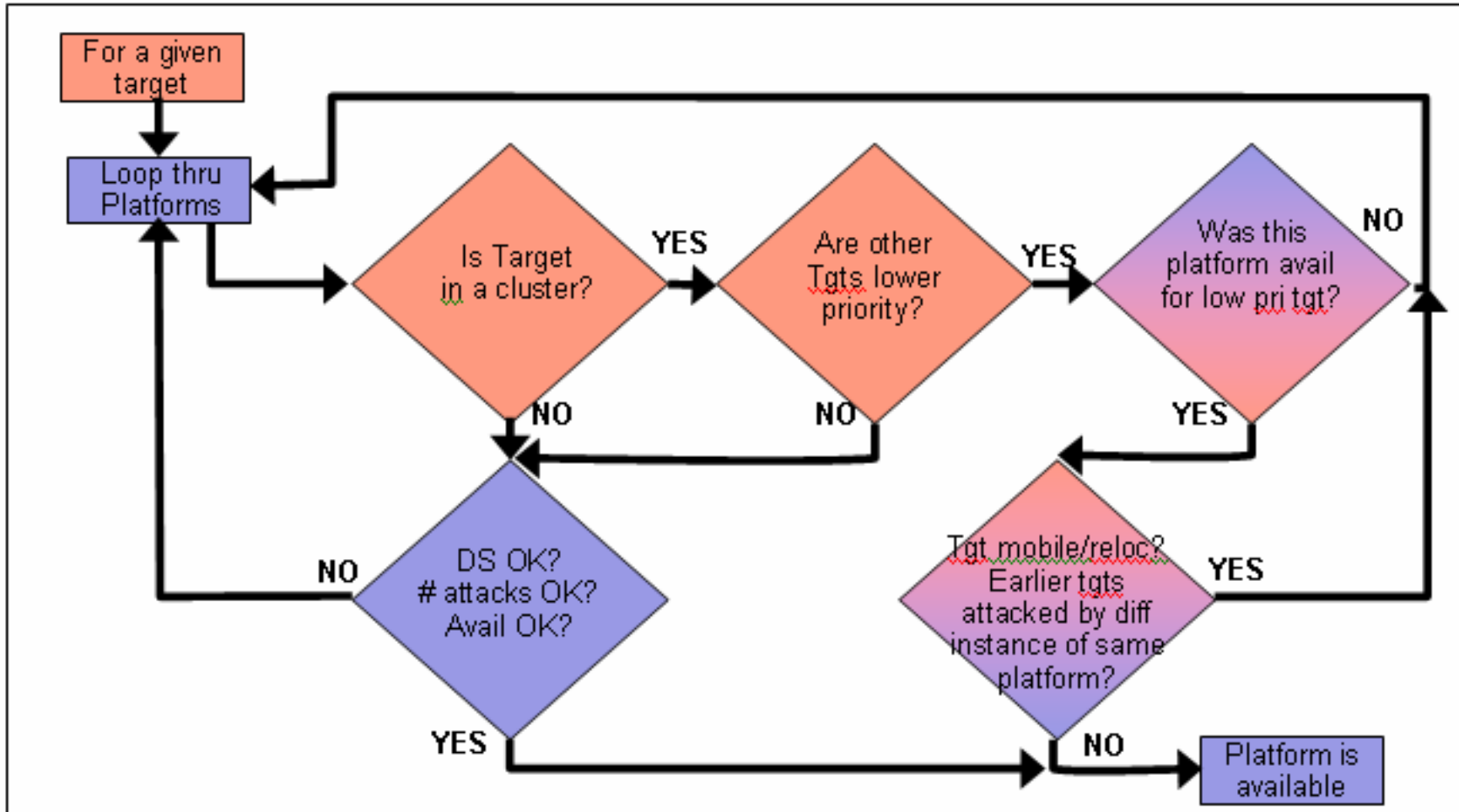


<b>ECR</b>	= Effective Casualty Radius
<b>ISR</b>	= Intelligence, Surveillance, and Reconnaissance
<b>MAGTF</b>	= Marine Air-Ground Task Force (any size)
<b>MEF</b>	= Marine Expeditionary Force (~50,000 troops)
<b>MCO</b>	= Major Combat Operations
<b>MEU(SOC)</b>	= Marine Expeditionary Unit (Special Operations Capable)
<b>NSFS</b>	= Naval Surface Fires Support
<b>OIF</b>	= Operation Iraqi Freedom
<b>ROE</b>	= Rules of Engagement
<b>SEAD</b>	= Suppression of Enemy Air Defenses
<b>SPMAGTF</b>	= Special MAGTF
<b>VBA</b>	= Visual Basic for Applications
<b>Weapons Systems</b>	
<b>AGS</b>	= Advanced Gun System
<b>AH-1</b>	= Cobra rotary wing aircraft
<b>AV-8</b>	= Harrier fixed wing aircraft
<b>DDG-51 Flt I/II</b>	= Guided Missile Destroyer w/ TLAM and one 5"/54 gun
<b>DDG-51 Flt IIA</b>	= Guided Missile Destroyer w/ TLAM and one 5"/62 ERM-capable gun
<b>DDG-1000</b>	= Land Attack Destroyer w/ TLAM and two AGS 155mm LRLAP
<b>F/A-18</b>	= Hornet fixed wing aircraft
<b>EFSS</b>	= Expeditionary Fire Support System
<b>ERM</b>	= Extended Range Munition
<b>HIMARS</b>	= High Mobility Artillery Rocket System
<b>JSF</b>	= Joint Strike Fighter fixed wing aircraft
<b>LRLAP</b>	= Long Range Land Attack Projectile
<b>M777</b>	= Lightweight 155mm Howitzer
<b>UH-1</b>	= Huey rotary wing aircraft

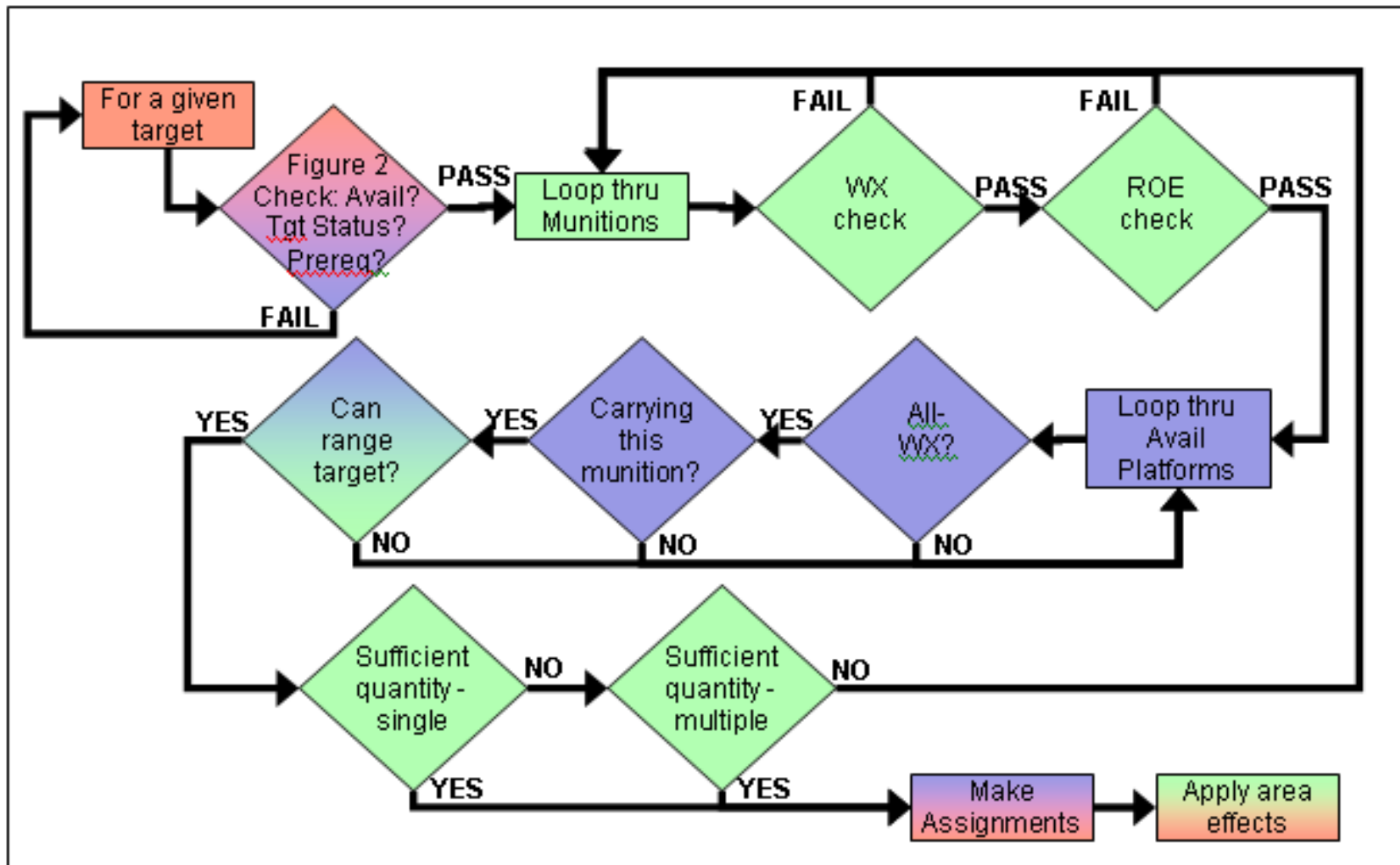
# Resource-to-Target Assignments



# MAGTF Fires Availability Module



# MAGTF Fires Assignment Module



### MAGTF Fires Model

1. Enter scenario data, target list, friendly fires assets, and munition characteristics in input tables.
2. Set desired number of iterations below.
3. Randomized seed: Choose.
4. Clear output tables (Output and Summary Sheets in this workbook) with the "Reset/Compact" button.
5. Begin the model iterations with the "Run Simul" button. Watch StatusBar at bottom for status during the run.
6. After viewing/copying/analyzing/Saving data, can use the "Reset/Compact" button to reduce file size -

**all simulation results will be lost, but inputs remain.**

RESET/COMPACT

RUN SIMUL

#### Input Guide

- Environmental
- Operational
- Technical
- Not currently used as input

# iterations:

Randomized seed?  (If FALSE, does same "random" sequence of iterations each Run.)

Input Workbook:  workbook used for all input. (thisworkbook or file name. Must be in this path. Do not include quotes.)

Filter for Targets Sheet:  refers to "Day" Column on Targets Sheet. Only uses filtered rows (Targets) on exact match.

Output Summary Tables:

Target Type(s)	Class Name (any entry OK)
<input type="text"/>	<input type="text"/>
<input type="text"/>	<input type="text"/>

COMPARE

Compare Output Sheets (thisworkbook.Output and .Summary) to Workbook:  Must be in this path. Pressing COMPARE will highlight (in the Output Sheets) all differences found. This is used mainly to verify code changes.

- \*\* conceptually, model assumes targets appear sequentially (in order of priority) and engagements occur instantaneously
- \*\* no issues with unit being unavailable because they are engaging another target
  - if tgts are in a cluster, then area wpns get area effects, and ground/naval assets are guaranteed availability for lower pri tgts in the cluster after initial attack, even for mobile/relocating tgts
- \*\* no delay for avn platforms to reach target
  - availability assumes avn platforms at CP, otherwise not avail
- \*\* subsequent sorties are available immediately (no deck cycle delay)
  - essentially, assumes some delay between target appearances
  - for large engagements, avail will mitigate (may not be avail for first tgts but may become avail for later tgts)

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# Output Fail Reason explained



- “N P#1M:JDAM-P no-go,ammo;P#2M:5HE-P no-go, rng;P#3M:120HE-P no-go, rng;P#4M:25mm-P no-go,ammo;P#5M:20mm-P no-go,ammo;try lesser effectP#1M:JDAM-P no-go,ammo; ... P#5M:20mm-P no-go,ammo;not assigned”
- Reads: For the desired effect (Neutralize): Priority#1 Mmunition:JDAM – No available platforms have any JDAMs remaining. Priority#2 Mmunition:5HE – No available platforms can range the target...  
For the next lesser effect (Suppress): Priority#1 Mmunition:JDAM...
- “not assigned” means Blue could not achieve even the lowest level effect (Suppress) on this Target.

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# MAGTF Fires Model Outputs other Output Tables



MAGTF Fires Model, Version 20070522. 5/31/2007 3:44:45 PM  
14 Targets, 6 Target Types, 7 Platforms, 8 Munitions, 8 Regions, 1 Iterations

Input Tables FilePathName = H:\HSave\MAGTF Fires\MAGTF Fires Model.xls

First Reason for each Munition why Desired Effect was not achieved for Targets that were not addressed at all (D,N,S):

Total of each Column is = 7, the number of non-addressed Targets over all Iterations.

Munition	120HE	5HE	20mm	Hellfire	TOW	25mm	JDAM	Maverick	Total	Percent
Mun Pref empty	6	6	0	1	1	0	6	1	21	38%
Mun Wx	0	0	0	0	0	0	0	0	0	0%
Mun ROE	0	0	0	0	0	0	0	0	0	0%
Mun Plt Wx	0	0	0	0	0	0	0	0	0	0%
Mun NoAmmo	0	0	1	6	6	7	1	6	27	48%
Mun Range	1	1	0	0	0	0	0	0	2	4%
Mun Lo#Ammo	0	0	6	0	0	0	0	0	6	11%
Mun Total	1	1	7	6	6	7	1	6	35/56	100%
Mun Percent	3%	3%	20%	17%	17%	20%	3%	17%	xxx	100%

Targets Effected, by Munition.

Desired Effect (D)	0	1	0	2	0	0	1	0	4	57%
Lesser Effect (L)	0	0	1	0	0	1	1	0	3	43%
D or L	0	1	1	2	0	1	2	0	7	100%
of Total D or L Tgts	0%	14%	14%	29%	0%	14%	29%	0%	xxx	100%
of Total Tgts*Iters	0%	7%	7%	14%	0%	7%	14%	0%	xxx	50%
Quantity, Initial	100	500	440	4	0	400	8	0	1,452	100%
Quantity, Final	100	495	280	2	0	200	0	0	1,077	74%