



# *Variable Damage Effects in Naval Wargames*

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*Admiralty Trilogy Seminar*



# Outline

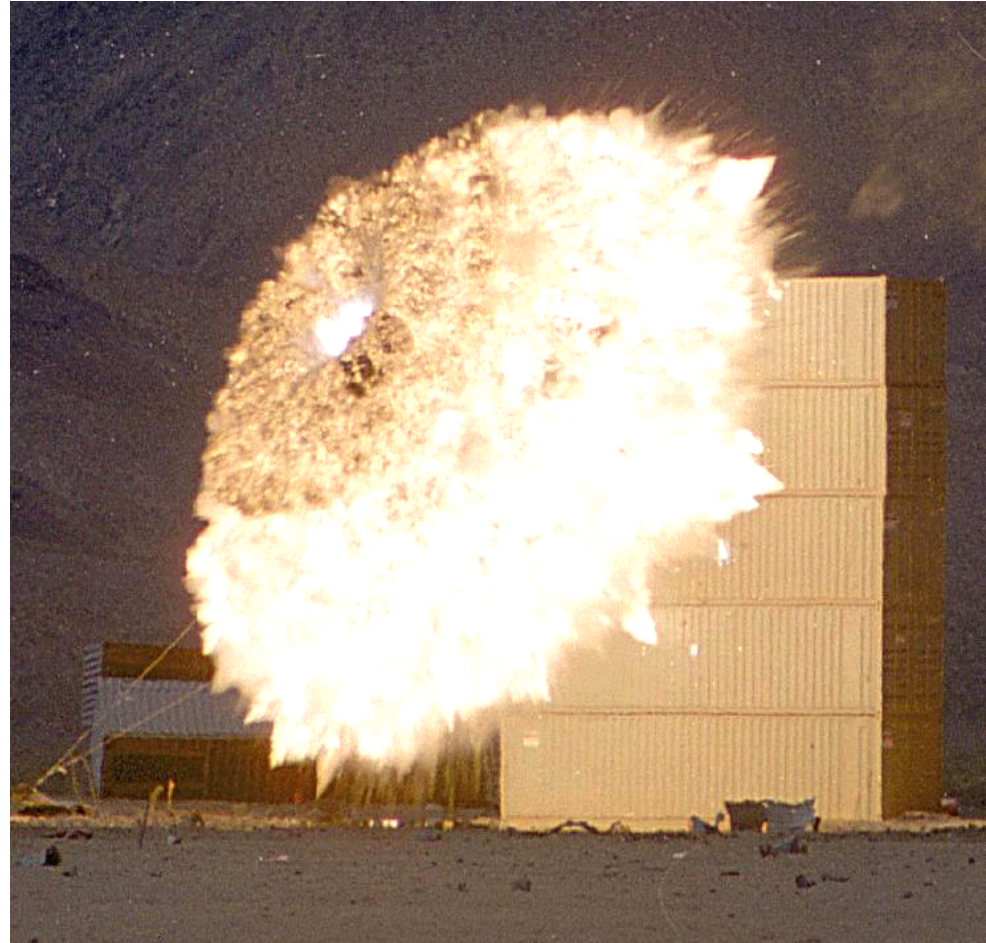
- ◆ **What is damage?**
- ◆ **Damage modeling philosophies**
- ◆ **Drivers in damage variability**
- ◆ **Modified AT fire and flooding critical hits**
- ◆ **Modified AT damage control**
- ◆ **Ship damage control capacity**
- ◆ **Conclusions**





# Weapon Damage Mechanisms

- ◆ **Explosives – Basis for damage mechanisms**
  - Rapid conversion of chemical potential energy into heat, smoke, noise and kinetic effects
- ◆ **Blast Effects**
  - Formation of a shock or high pressure wave
- ◆ **Fragmentation Effects**
  - Breakup and acceleration of case material
- ◆ **Incendiary Effects**
  - Generates a lot of heat





# What is Damage?

- ◆ **Damage is the result of explosive effects that causes a degradation in a ship's functions and/or seaworthiness**
- ◆ **Degradation to a ship's functions**
  - Propulsion – Movement
  - Sensors – Detection
  - Weapons – Attack/Engage
- ◆ **Degradation to a ship's seaworthiness**
  - Loss of flotation
  - Loss of stability
- ◆ **How do we “measure” damage?**
  - Mobility kill
  - Firepower kill
  - Mission kill
  - Hard kill





# Damage Modeling Philosophies

- ◆ **The approaches to modeling damage are numerous and varied**
- ◆ **Fred T. Jane abandoned any attempt to objectively model damage in his naval game, left the determination to a knowledgeable Umpire – completely subjective**
- ◆ **U.S. Naval War College Fire and Maneuver Rules adopted a totally objective approach by using a Lanchester-like attrition equation**
- ◆ **The majority of naval wargames attempts to define a damage capacity for ships based on size and construction**
  - **Hybrid subjective/objective approach**



# Damage Modeling Philosophies

- ◆ **Royal Navy War Game Rules 1929 and the popular Fletcher-Pratt Naval Wargame use a gradual degradation approach**
  - Damage capacity is defined – point system
  - Speed lost as a function of overall damage
  - Firepower lost as a function of damage
  - Often referred to as the “Salami slice” approach to damage
- ◆ **Battle Stations! used two concepts: gradual degradation and location/system specific (Damage Effects Cards)**
  - Firepower, flotation, and speed degrades gradually using the Non-Specific Hit Method
  - Firepower, flotation, and speed degrade by means of a critical hit and hit location concept in the Specific Hit Method

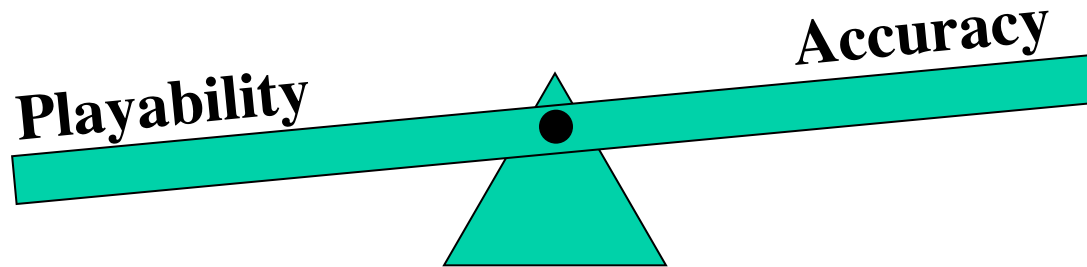


# Damage Modeling Philosophies

- ◆ **Seekrieg uses an in depth damage effects approach to simulate ship function and flotation degradation**
  - Uses damage points as a measure of ship damage capacity
  - Uses nested damage effects die rolls and tables
  - Hit location specific
- ◆ ***Admiralty Trilogy* naval wargames**
  - Uses damage points as a measure of ship damage capacity
  - Uses critical hit system to provide random elements
  - Minimizes the use of hit location



# Damage Modeling Philosophies



- ◆ **Damage is perhaps the hardest concept of combat to model**
  - Detection – very well documented, considerable experimentation
  - Hitting – reasonably well documented, good base of experimentation
  - Damage – not well documented, limited experimentation
    - Many exceptions to the “rule”
    - Modeling approach depends on where you sit on the see-saw
- ◆ **Models are a representation of a real object or process**
  - Compromises are nearly always required to get one to work
- ◆ **“All models are wrong. Some models are useful.”**
  - Mr. George Box





# Level of Variability in Damage Models

- ◆ **Jane's Naval Game – Very high variability, inconsistent**
- ◆ **U.S. Navy Fire and Maneuver Rules – No variability**
- ◆ **Royal Navy War Game Rules 1929 – No variability**
- ◆ **Fletcher-Pratt Naval Wargame – No variability**
- ◆ **Battle Stations! – No variability/High variability**
- ◆ **Seekrieg – High variability**
- ◆ **Admiralty Trilogy – Low variability**
  
- ◆ **CONUNDRUM:** Players want speed of play, accuracy, *and* high variability



# Damage Variability Drivers

## ◆ Hit location

- Multiple hits in the same place doesn't result in equal degradation, “bouncing the rubble”
- Will slow game play

## ◆ Variations in warhead performance

- Often described as the best way to obtain damage variability
- Problem: Damage effects are not linear
  - 50% loading detonation results in nearly 80% of the damage effects
  - Greater than 100% damage effects result due to “other factors”

## ◆ Secondary effects

- Fire and flooding are the two main actors
- Function reducing critical hits
- Historically this is where variability comes into play



# Current AT Damage Variability

- ◆ **Weapon damage has been a fixed value based on warhead weight**
  - Critical hit system provided specific function degradation
  - Additional speed reductions through general ship damage
  - Fire and flooding provide the extra effects
- ◆ **The issue with players is that our system isn't very variable**
  - Fire and flooding occurs in fixed intervals
    - **Minor Fire/Flooding: 2%/3%/4% of ship's original DPs**
    - **Major Fire/Flooding: 4%/6%/8% of ship's original DPs**
    - **Severe Fire/Flooding: 6%/9%/12% of ship's original DPs**
- ◆ **Damage control results in a step reduction (or increase)**
- ◆ **Catastrophic loss if fire and flooding gets too high**



# Revised AT Damage Variability

- ◆ **Damage points based on total energy raised to the 1/3 power**
  - **Blast Energy**
  - **Fragmentation kinetic energy**
  - **Kinetic energy of residual mass for missiles**
  - **Will remain a fixed value**
- ◆ **Fire and flooding critical hits will be shifted to a die roll**
  - **Pre-dreadnought era ( $\leq 1907$ ): 2d6+2**
  - **World War I era (1908-1924): 1d6+2**
  - **World War II – Modern ( $\geq 1925$ ): 1d6**
- ◆ **Non-penetrating fire and flooding damage is halved**
- ◆ **Fire and flooding damage cause by small guns ( $< 76\text{mm}$ ) is halved**



# Revised AT Damage Variability

- ◆ **Shellfire and bombs: Fire and flooding critical hit damage goes into effect three Tactical Turns later**
  - Takes time for the fire and flooding to spread beyond the immediate affected area
    - WET showed that it takes about 9 to 12 minutes for a fire to fully develop
    - Flooding, even through a large caliber shell hole, takes time to affect the ship's stability
    - Effects are not made public – introduces a little “Fog of War”
- ◆ **Torpedo and mines: Flooding critical hit damage goes into effect immediately**
  - Multiple compartments are flooded when the torpedo/mine warhead explodes
  - Ship stability is affected instantly



# Damage Control

- ◆ **Additional variability is being introduced by making the damage control procedure a die roll as well**
- ◆ **Success depends on how badly the ship's damage control cadre is stressed**
  - **Larger ships can handle more secondary damage**
    - **U.S. WWII DD had 35-40 highly trained DC personnel (3 teams)**
    - **U.S. WWII BB had 35-40 trained men *per* team (6 teams)**
  - **Clarifies how nearby ships can lend assistance**
- ◆ **The terms “Minor,” “Major,” “Severe,” and “Overloaded” now refer to the overall load on the damage control teams**



# Severity Conditions

<b>Size Class</b>	<b>Minor</b>	<b>Major</b>	<b>Severe</b>	<b>Overwhelmed</b>
A	1-10%	11-15%	16-17%	≥18%
B	1-10%	11-15%	16-17%	≥18%
C	1-8%	9-12%	13-14%	≥15%
D	1-8%	9-12%	13-14%	≥15%
E	1-6%	7-10%	11-12%	≥13%
F	1-6%	7-10%	11-12%	≥13%
G	1-6%	7-10%	11-12%	≥13%

**Modified by era range of values: -2% to +2%**



# Damage Control Die Roll

Die Roll	Minor	Major	Severe	Overwhelmed
1	-2d6%	-2d6%	-2d6%	-1d6%
2	-2d6%	-2d6%	-1d6%	-1d6%
3	-2d6%	-1d6%	-1d6%	-1d6%
4	-1d6%	-1d6%	-1d6%	No Change
5	-1d6%	-1d6%	No Change	No Change
6	-1d6%	No Change	No Change	+1d6%
7	No Change	No Change	+1d6%	+1d6%
8	No Change	+1d6%	+1d6%	+1d6%
9	+1d6%	+1d6%	+1d6%	+2d6%
10	+1d6%	+1d6%	+2d6%	+2d6%





# Damage Control Odds & Ends

- ◆ **Fire and flooding damage control die rolls are resolved separately**
- ◆ **A ship can temporarily increase its damage control capacity, by one half of its Minor value, at the expense of combat capability**
- ◆ **Other ships can lend support to reduce the Severity Condition – up to half of their Minor capacity**
- ◆ **If either fire or flooding place a ship in an overwhelmed Severity Condition can lead to catastrophic loss**
- ◆ **Overall Critical Hit table being modified to take into account space allocation**
  - **More likely to get engineering hit vice rudder or bridge hit**



# Example

- ◆ **USS *Lexington* – hit by several bombs and torpedoes**
  - Secondary fire damage: 16%
  - Secondary flooding damage: 8%
  - Total = 24% and exceeds the ship's Overwhelmed status
- ◆ **Actions by CO**
  - Commits deck crew to DC efforts: +5%
  - Two DD's come alongside to assist: +4% each
- ◆ **Severity condition decreases to Major**
  - 24% - 5% - 8% = 11%
  - *Lexington* is in a good position to combat the casualties



# Conclusion

- ◆ **Damage variability is a high interest item for players**
  - Variability drivers: Location, warhead performance, secondary effects
  - *Admiralty Trilogy* games don't use specific hit locations
  - Warhead performance variability isn't realistic
  - Secondary effects the best option for our games
- ◆ **Damage effects are very difficult to model**
  - Significant tension between playability and accuracy
- ◆ **Revised model gives greater variability in fire and flooding critical hits and in the DC die rolls**
- ◆ **Delayed implementation of some critical hit results means ships aren't instantaneously crippled**