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Leveraging the Video Game Industry: User Telemetry For Fire Control

Joint Armaments Conference & Exhibition 2012
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- Classification: UNCLASSIFIED
- Type of Briefing: INFORMATIONAL

Agenda

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- What is User Telemetry?
- How is it used by the video game industry?
- 3 benefits of User Telemetry
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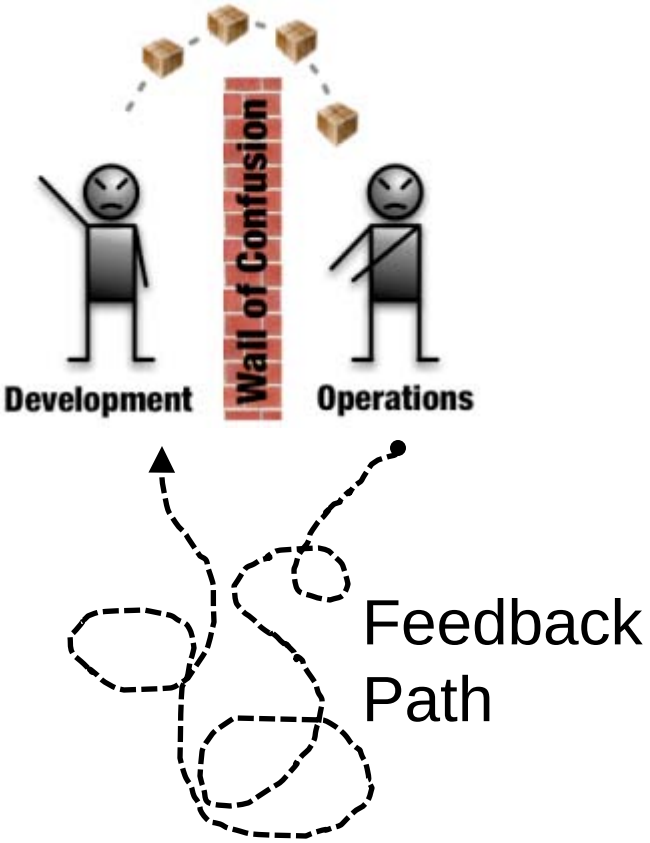
  - How well the system is used
- Tactical considerations
- Can we cheat Heisenberg?
- Lessons learned
- Conclusions
- Acknowledgements

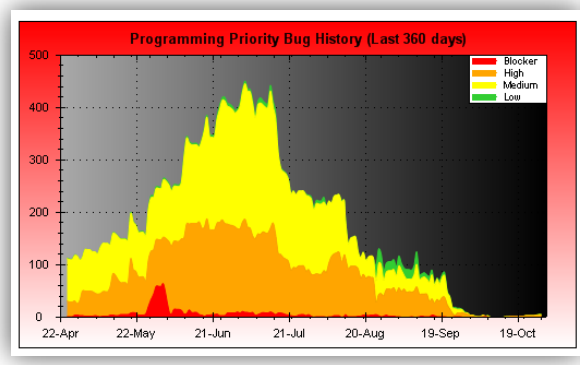
Introduction

- Currently serve as Project Lead for the fire control system on the Army's new M109 PIM howitzer.
- Frustration with current post development feedback methods
  - Test Incident Reports
  - User Juries
  - Lack of objective tactical performance data
- Looked to the video game industry
  - Worldwide market >$65 billion / year
  - Rapidly evolving and highly competitive
  - Perfect laboratory for new development techniques
  - High use of user telemetry



What is User Telemetry?

- **n.** The science and technology of automatic measurement and transmission of data by wire, radio, or other means from remote sources, as from space vehicles, to receiving stations for recording and analysis.
- Instead of pulling data from space, we're interested in observing what our users are really doing with our weapon systems.



How is it used by the video game industry?

- Current generation systems (XBox360, Wii, PS3) have ‘always on’ broadband connectivity
- First generation of consoles to allow post launch patches and updates
- Games encourage players to log in to game servers while playing for additional features
- While online, many user metrics are tracked; sometimes in real time
  - Understand how customers experience the game
  - Identify and react to post launch issues
  - Understand the market and learn for future games

Industry Example (SkyNet)

- Example Telemetry System: SkyNet
- 2nd Generation homegrown telemetry designed and used by BioWare
- Used to track games like Dragon Age: Origins and Mass Effect 2
- Millions of game sessions tracked
- 50,000+ bugs found
- Aggregate data visualization
- Capability to drill down to individual events or sessions
- Tracks not only bugs, but user preferences and procedures

SkyNet

3 Benefits of User Telemetry

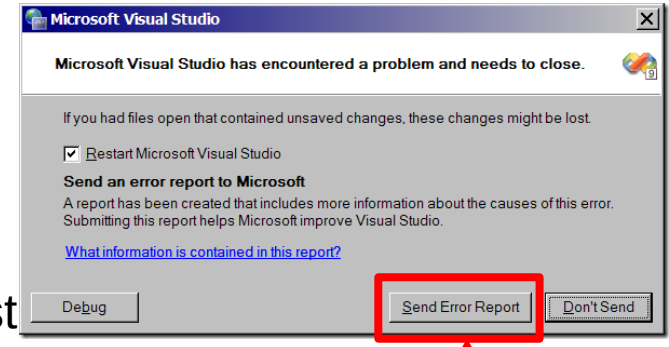
How the observed system fails

How the observed system is used

How well the observed system is used

How the system fails

- Automated discovery of system faults and failures
  - Pre or post release
- Objective system state data surrounding failure event
  - Software version
  - Location data
  - Ammo data
  - Target data
  - Timestamp
  - Etc.
- Automated population of defect tracking systems
- Severity and frequency data for prioritization and cost benefit analysis
- <u>Not dependent on users elevating a problem</u>
- <u>Not intended as 'black box' or court marshal device</u>



How often do you actually push this?

<u>Who benefits from the data</u>?
- Development Team
- Project Management Team
- User

Malcolm Baldrige National Quality Award 2007 Award Recipient

How the system fails

Defect Name	Field Fault Report	# 104393492	ffected
NAV Resta	Gun #:	627	
	Unit:	Bravo Bat, 1st 10th FA	26, etc
Radar Out	Defect Category:	System Lockup	66, etc
System Lockup	Date Time Group:	2012:02:15:15:30.52 UTC	025
	Software Version:	V4.2_main_0015	
	Unit Location:	18 630084E 4833438N	
	Target Location:	18 630042E 4839394N	
	Mission Ammunition:	M107DC, M557, M232A2	
	Other errors on this gun:	52164869, 124817861	

How the system is used

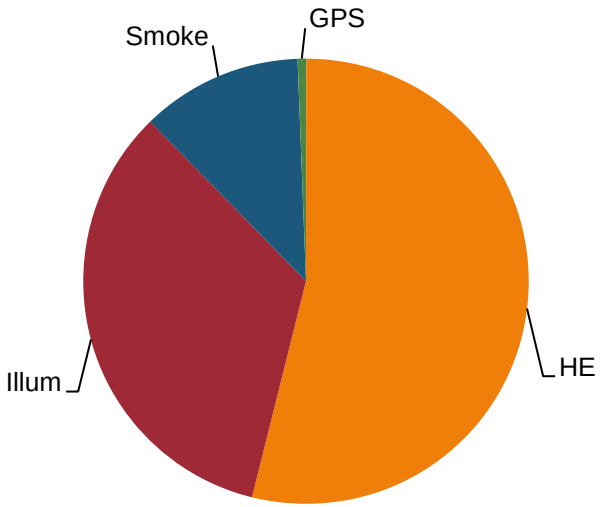
- Which modes and methods are favored and which are underutilized
  - If some modes are heavily used maybe they deserve more attention going forward
  - Are underutilized modes faulty or just not useful?
- Discover unexpected use cases and mission threads
  - Soldiers will use the system in ways never intended or imagined by engineers
  - Could lead to new supported functionality or discovery of non-optimal methods

Who benefits from the data?
- Project Management Team
- Training Team
- Logistics

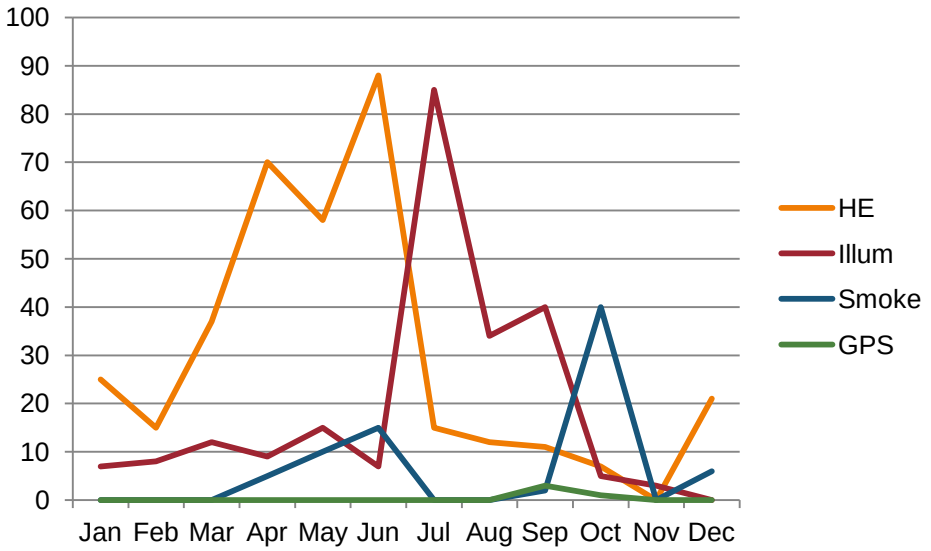
How the system is used

Example: Focus on one variable such as munitions used

Types of munitions used



Munitions usage over time

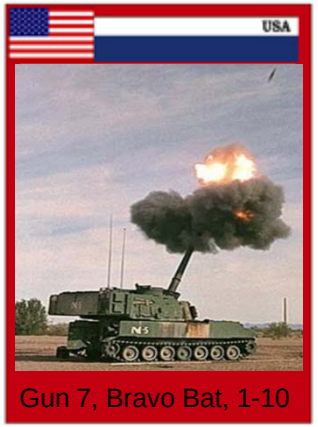


Could sort data by:

- Entire Army
- Theater
- Division
- Unit

How well the system is used

- Tracking of key performance parameters
  - Time to fire, % successful engagement, etc
  - “Baseball Card” stats for the vehicle or system
- Discover unknown problematic tasks
  - Use cases that are prone to failure
  - Could be due to bad equipment, training or design
- Track performance from unit to unit
  - Which units meet goals [KPP’s] and which need help
  - Drill down further to determine potential causes of unit performance
- Rate training effectiveness and refine materials to address deficiencies



Gun 7, Bravo Bat, 1-10

Who benefits from the data?
- Training Team
- Project Management Team
- Intel

How well the system is used

1-10 Field Artillery Battalion
Bravo Battery – Gun 7
Performance

KPP	Standard	Actual (avg)
Time to emplace	60 sec	58.7 sec
Time to fire	60 sec	52.2 sec
Burst rate	3 rpm	4.15 rpm
Mean time between error	100 hr	152.9 hr

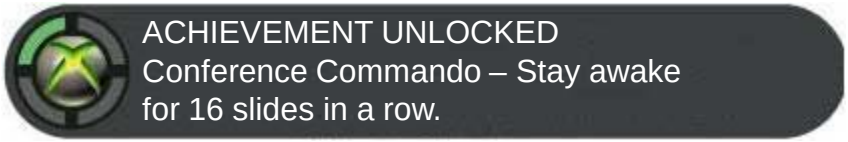
Readiness Issues
Intermittent transmission failures
Tube at 98.5% allowable wear
Uptime of battery exceeds nominal lifespan by 124%

Tactical considerations

- Video game industry: ‘always on’ broadband
- Tactical platforms
  - Limited or no live reach back
  - Compress key data points for periodic manual removal
- Key factors:
  - Available data pipe
  - Possible classification of data
  - Amount of data in question
- Not to be used against the user or as a court martial device
- Individual use data may not be sensitive
- Amalgamation of data may need to be classified
  - Average M1 uptime across the Army
  - Average Aegis response time
  - etc

Can we cheat Heisenberg?

- Is it possible to monitor the user without altering his/her normal behavior?
  - Most video game users are unaware of any measurement
  - Our user community is more skilled, more aware, and much smaller
- Will the user try to ‘cheat’ their statistics?
- Do we even want to remain unseen?
- Video game achievements
  - Monitor key events
  - Encourage specific user behavior
- Could be used to mold user behavior:
  - Provide recognition
  - Inspire competition
  - Create peer pressure



- Can backfire
  - ‘Play the game’ rather than accomplish mission
  - Concern scores will be used to formally rate or punish

Georg Zoller
Lead Technical Designer
BioWare

- Start small and keep it simple
- Remain non-invasive and minimize footprint into the system
- Reuse test hooks if possible
- Make it simple to expand
- Spend more time working on the visualization of the data than the collection
- Collect and present data without forcing conclusions

Conclusions

- The video game industry is one of the largest and most rapidly evolving software development groups in the world.
- User telemetry changed the way games are built and it can do the same thing for weapon or military systems.
- Improved methods to:
  - Find and fix bugs
  - Refine the system from one version to the next
  - Train the warfighters that use them
- Objective data on system usage will lead to:
  - Better performance
  - Faster responsiveness
  - Reduced cost

Acknowledgements

- Georg Zoller, Lead Technical Designer, BioWare Austin
- Extra Credits webseries:
  - Daniel Floyd
  - James Portnow
  - Allison Thesus

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