The Impact of Equipment Weight on the Dismounted Soldier`s Operational Performance

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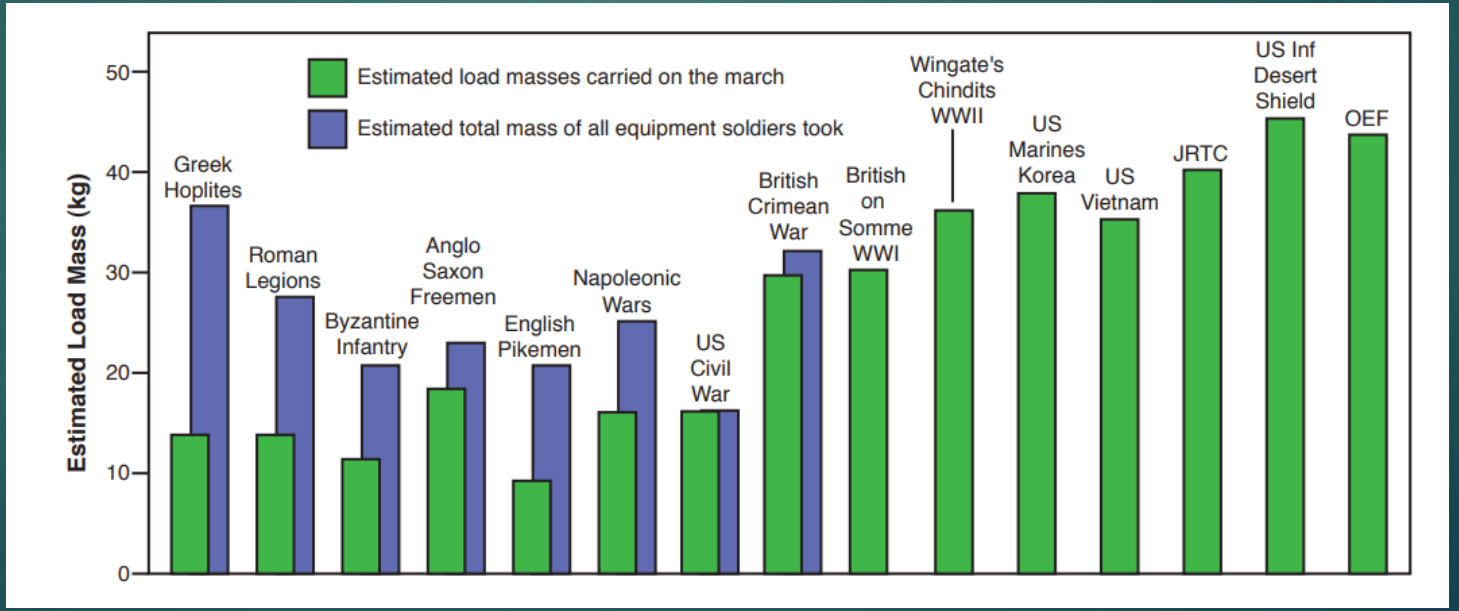
Operational Effectiveness

The ability of a military to employ its forces to achieve strategic objectives as part of a military campaign.

Military Effectiveness in the Long War. MAJ Wright WJ. US Army, May 2007.

The Overburden Problem

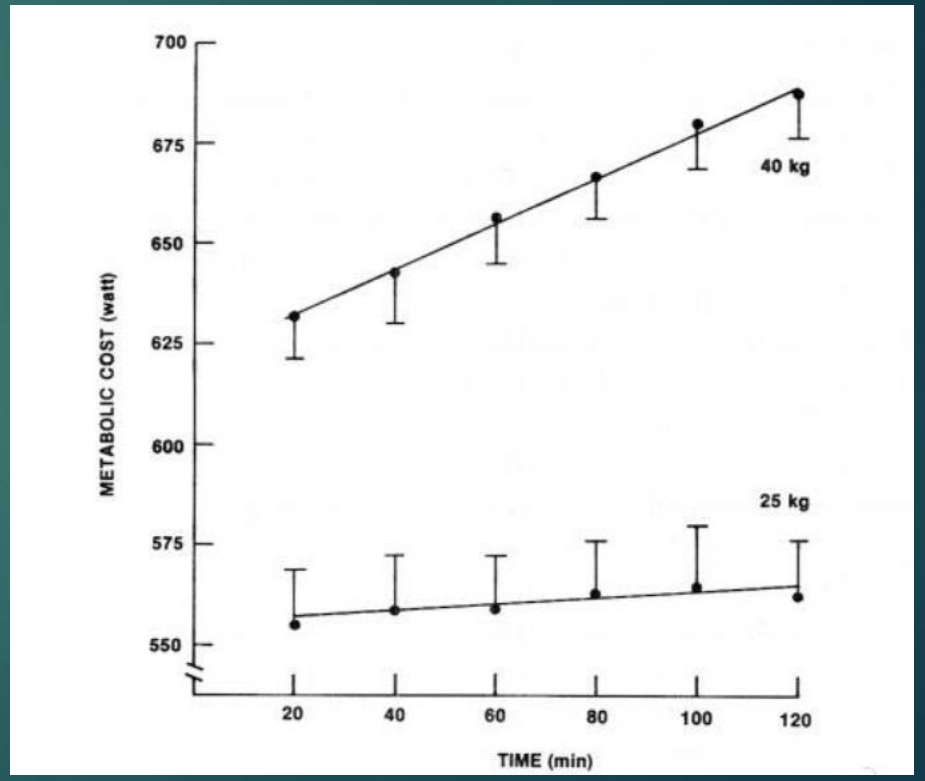
- The purpose of introducing new technologies to the battlefield is creating a technological-qualitative superiority and reducing the degree of uncertainty, e.g. vision devices, drones, etc.
- At the same time, these systems increase the amount of the carried equipment and thus increase the degree of uncertainty regarding the performance of the individual soldier.



Load Carriage in Military Operations. Knapick J.; Reynolds K.

Previous Studies

- The majority of the studies focus on physiological and biomechanical changes.
  - Energy Cost (VO_2 max, HR, etc.)
  - Body Temperature
  - Walking Speed
  - Posture
- Some studies try to asses the effects of equipment weight on combat task performance. But the correlations between weight and military task performance still remains unclear.



External load can alter the energy cost of prolonged exercise
Epstein Y. et. al.

Methods

- The data for the analysis was obtained from Philip JC Ashbey (PASS 2002) that performed a study with instructors from the Royal Naval Commandos Training Center in order to find the trade-off between the personal armor's protection level and the soldier's performance.
- The study included five tests and six different armor systems (marked A through F) with increasing weight (from 2.2 kg to 12.6 kg) and was executed by six soldiers (marked Cpl A through F).
- The tests included:
  - Assault Course 500m
  - Fire & Maneuver 400m
  - Fireman's Carry 200m
  - 30ft Rope Climb
  - Shoot(45 rounds simulated 100m)

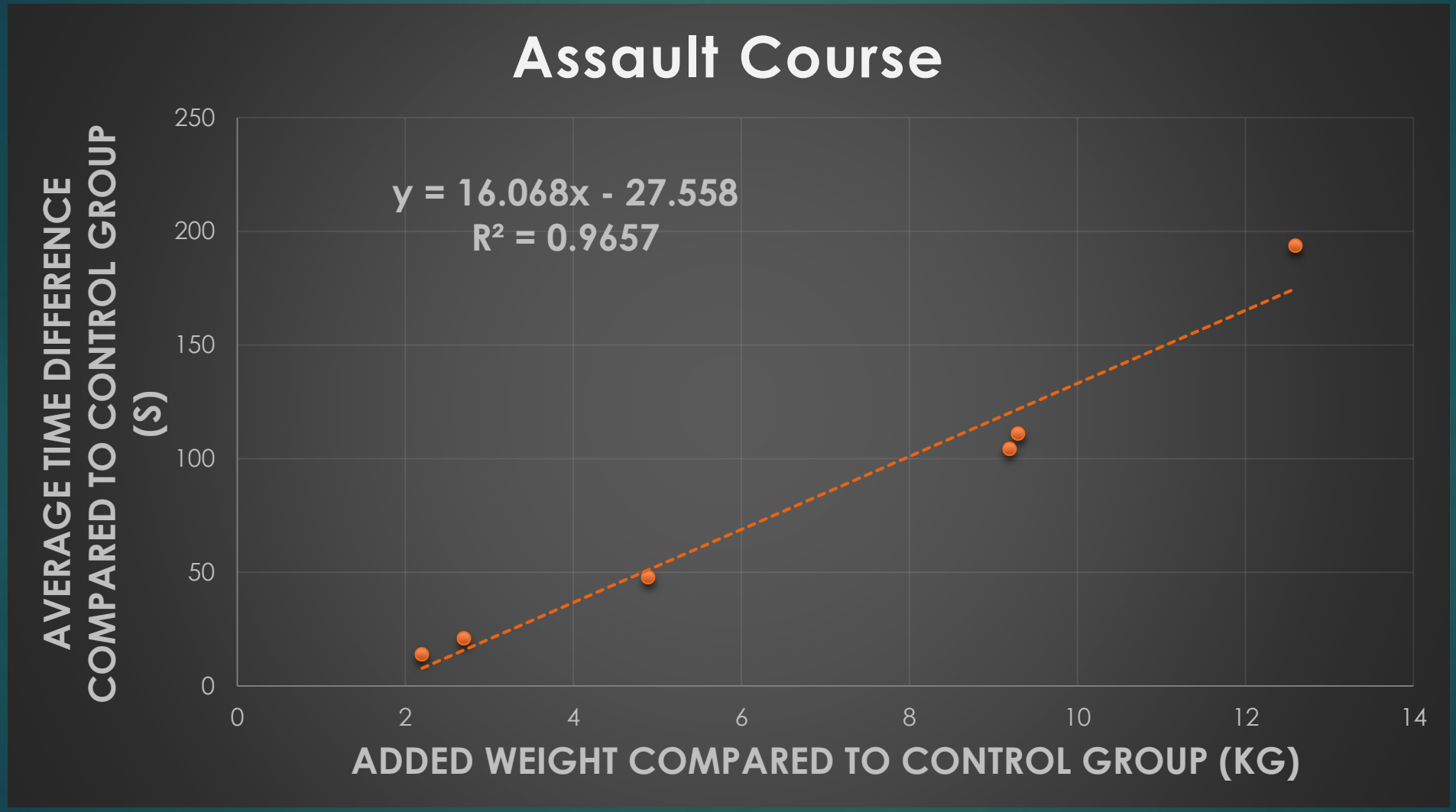
Methods – Cont.

- For each test (except the Rope Climb and Shoot tests), an average time for completion and an average time difference from the control group were calculated.
- For the Shoot test, an average number of hits and the number of misses compared to the control group was calculated.
- For each test, we tried to investigate the relationship between equipment weight differences and task performance.

Analysis Example – Assault Course

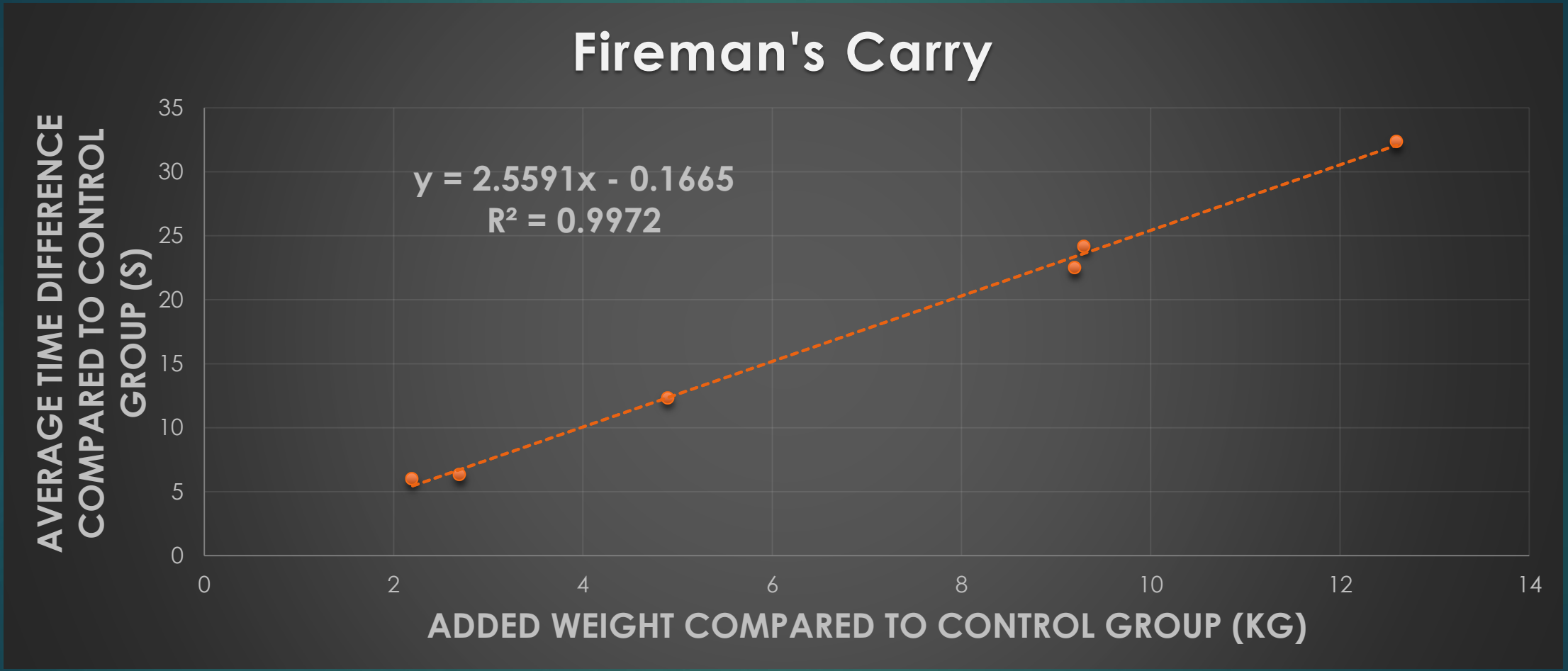
	Total Weight (kg)	Added Weight (kg)	Cpl A (s)	Cpl B (s)	Cpl C (s)	Cpl D (s)	Cpl E (s)	Cpl F (s)	Average Time (s)	Average Time Difference (s)
Basic Equipment (Control)	16	0	198	185	220	215	192	212	204	-
Equipment + Sys A	18.2	2.2	220	200	237	225	202	222	218	14
Equipment + Sys B	18.7	2.7	228	206	241	232	210	231	225	21
Equipment + Sys C	20.9	4.9	262	222	280	261	235	249	252	48
Equipment + Sys D	25.2	9.2	302	276	355	325	291	299	308	104
Equipment + Sys E	25.3	9.3	306	291	370	320	299	302	315	111
Equipment + Sys F	28.6	12.6	371	359	560	383	349	362	397	194

Results – Assault Course



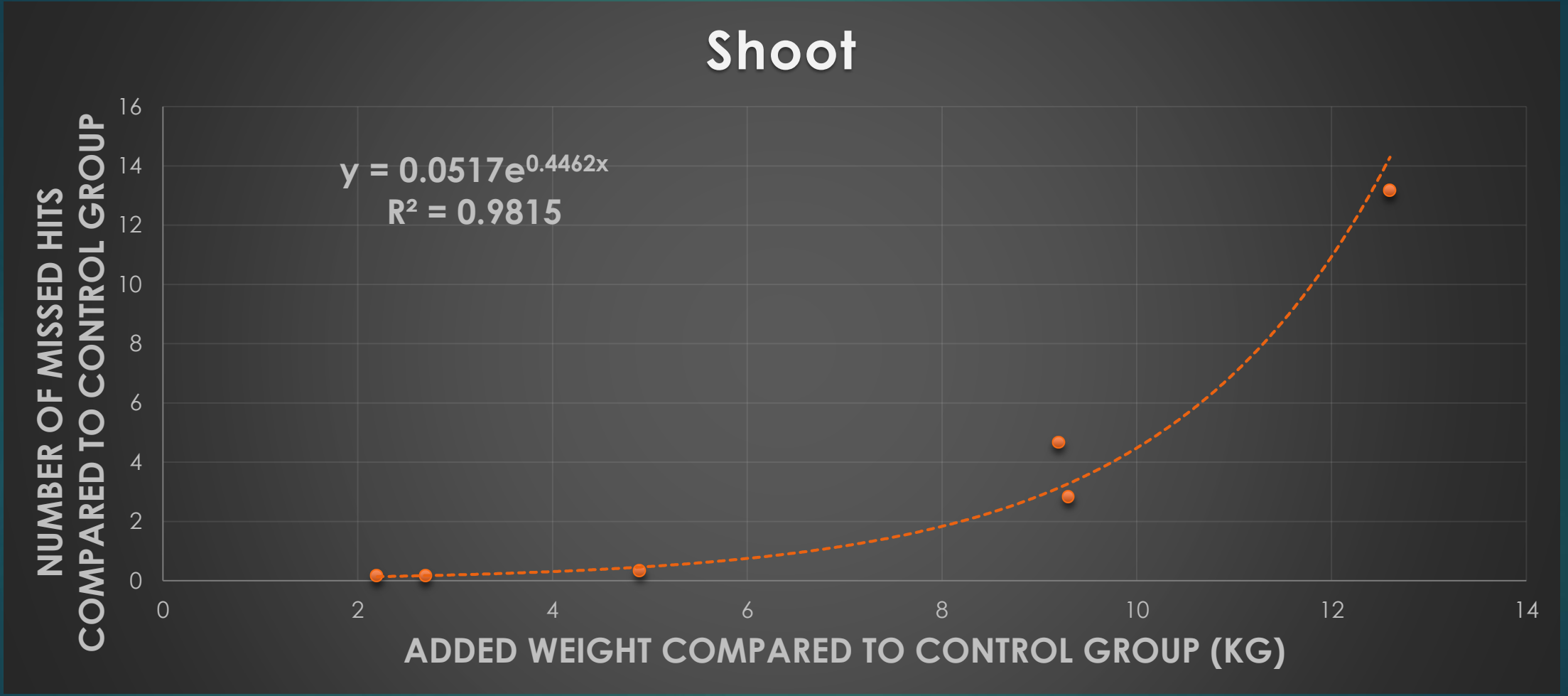
Results – Fire & Maneuver

Results – Fireman's Carry



Goal: Less than 90 seconds.
An addition of more than 9.3KG will prevent achieving that goal.

Results – Shoot



An addition of 15.2KG will result in zero hits on the target from 100m

Discussion

- Our work lacks data in order to achieve statistically significant results.
- Our analysis suggests a possible mathematical behavior between increment of equipment weight and decreasing performance of the soldier.
- If such mathematical formulas will be available, they can provide commanders with tools for designing and planning tactics, and improve the overall combat effectiveness.
- The main role of the dismounted soldier, is in fighting and not only reaching their destination. In light of the current and previous studies it is clear that high loads impair the soldier's capability of achieving that part of the mission.

Questions?

Thank You