



# CHARACTERIZATION OF THE PHYSICAL DEMANDS & FITNESS FOR PURPOSE IN AUSTRALIAN TANKER BASED BUSHFIRE FIGHTERS

**Matthew Phillips**

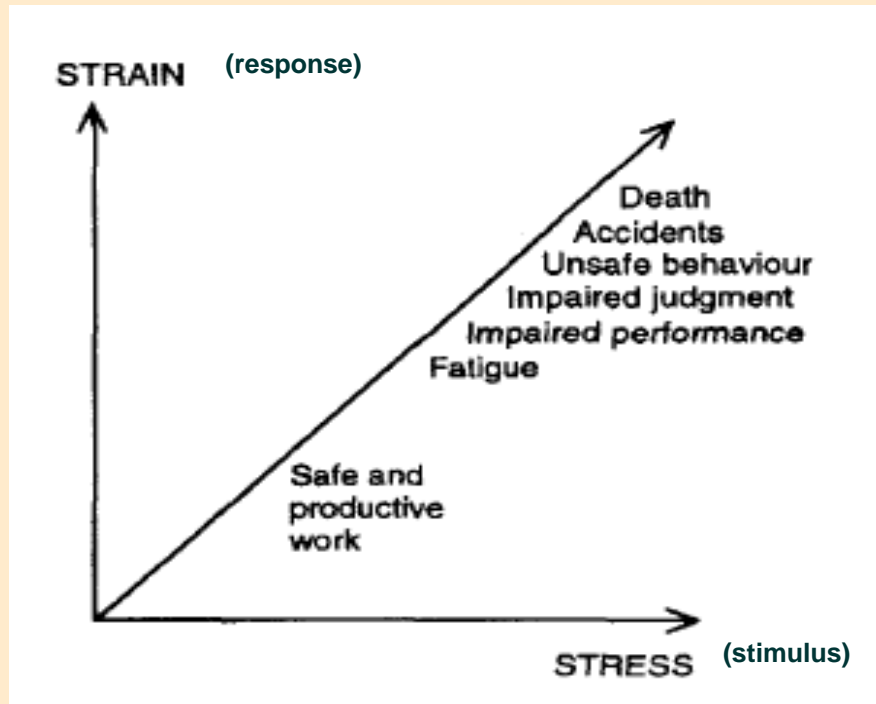
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# Fire ground Stress and Strain



Budd, Brotherhood et al. (1997). Project Aquarius

**What is the best way to identify individuals at risk on the fire ground?**



**Fitness for purpose (operational readiness) testing**



## Project Goals

1. Identify the physical demands of common bushfire tasks
2. Quantify the hardest fire fighting tasks
3. Validate a method to ensure bushfire fighters are operationally fit for purpose



## Deliverables for Agencies

1. Quantified data on simulated bushfire suppression tasks
2. A reliable and valid fit for purpose protocol for tanker based bushfire fighting



- Simulated Vs Real
  - Operational assistance
  - Compared to real time bushfire data
  - Reproducible
  
- Variety of physiological measures:
  - Heart rate
  - Physical activity
  - GPS (speed, elevation & distance)
  - Task Duration
  - Expired air (gold standard)



# Subject Characteristics



- Greendale and Blackwood brigades (Region 15)
- Multiple participations May - September 07
- Temp ranges between 4.5 & 16.9°C

	<b>Value ± SD</b>	<b>Range</b>
N	25	19M, 6F
Age (yrs)	43.8 ± 14.5	16 - 67
Height (cm)	170.0 ± 8.6	151.3 - 183.6
Weight (kg)	81.0 ± 14	51.2 - 103.9
BMI	28.1 ± 3.4	20.3 - 31.1
Years of Service	10 ± 9.2	0.5 - 30

# Individual task demands



Ten major tasks included with positional, gradient & operational variations

Fireground task	Position	Oxygen Consumption (L/min)	Duration (sec)
Static hose spray (n = 7)	Solo	0.81 ± 0.26	120.20 ± 0.26
Blacking out with hose (n = 14)	Lead position	1.57 ± 0.33	127.45 ± 30.42
Charged hose advance on flat ground (n = 9)	Lead position	1.88 ± 0.69	46.06 ± 6.81
Spot fire rake hoe work (n = 14)	Solo (75 strokes)	2.32 ± 0.56	100.75 ± 16.48
Hose advance uphill (n = 9)	Second position	2.55 ± 0.48	68.65 ± 14.44
Prolonged rake hoe work (n = 10)	Solo	2.56 ± 0.31	121.06 ± 12.51

\* 40-49 year old Australian men have an average maximum oxygen consumption of 2.88 L/min OR 89% of max for hose advance uphill

# Task demand: Intensity Vs. Duration

Physical demands of tanker based fire fighting

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**Men**

Classification ↓

	<50 sec	50-100 sec	100+ sec
<b>Light</b>			Static hose spray
<b>Moderate</b>	Quickfill pump carry Charged hose advance (75m)	Hose advance 80m flat	Quickfill pump trailer set up
<b>Heavy</b>	Charged hose advance (75m)	Manual hose retraction 75m	Blacking out (hose)
<b>Very Heavy</b>	Charged hose advance (75m)		Spot fire rakehoe Knapsack hiking Blacking out (rakehoe) Knapsack spraying
<b>Unduly Heavy</b>		Hose advance 80m uphill	Prolonged rakehoe

**Women**

Classification ↓

Duration →

	<50 sec	50-100 sec	100+ sec
<b>Light</b>			
<b>Moderate</b>	Quickfill pump carry		Static hose spray
<b>Heavy</b>	Charged hose advance (75m)	Hose advance 80m flat	Quickfill pump trailer set up
<b>Very Heavy</b>	Charged hose advance (75m)		Blacking out (hose)
<b>Unduly Heavy</b>	Charged hose advance (75m)	Hose advance 80m uphill Manual hose retraction 75m	Knapsack spraying Prolonged rakehoe Spot fire rakehoe Knapsack hiking Blacking out (rakehoe)

Intensity Classifications from: McArdle WD, Katch FI and Katch VL (1996). **Exercise Physiology**. Fourth edition.

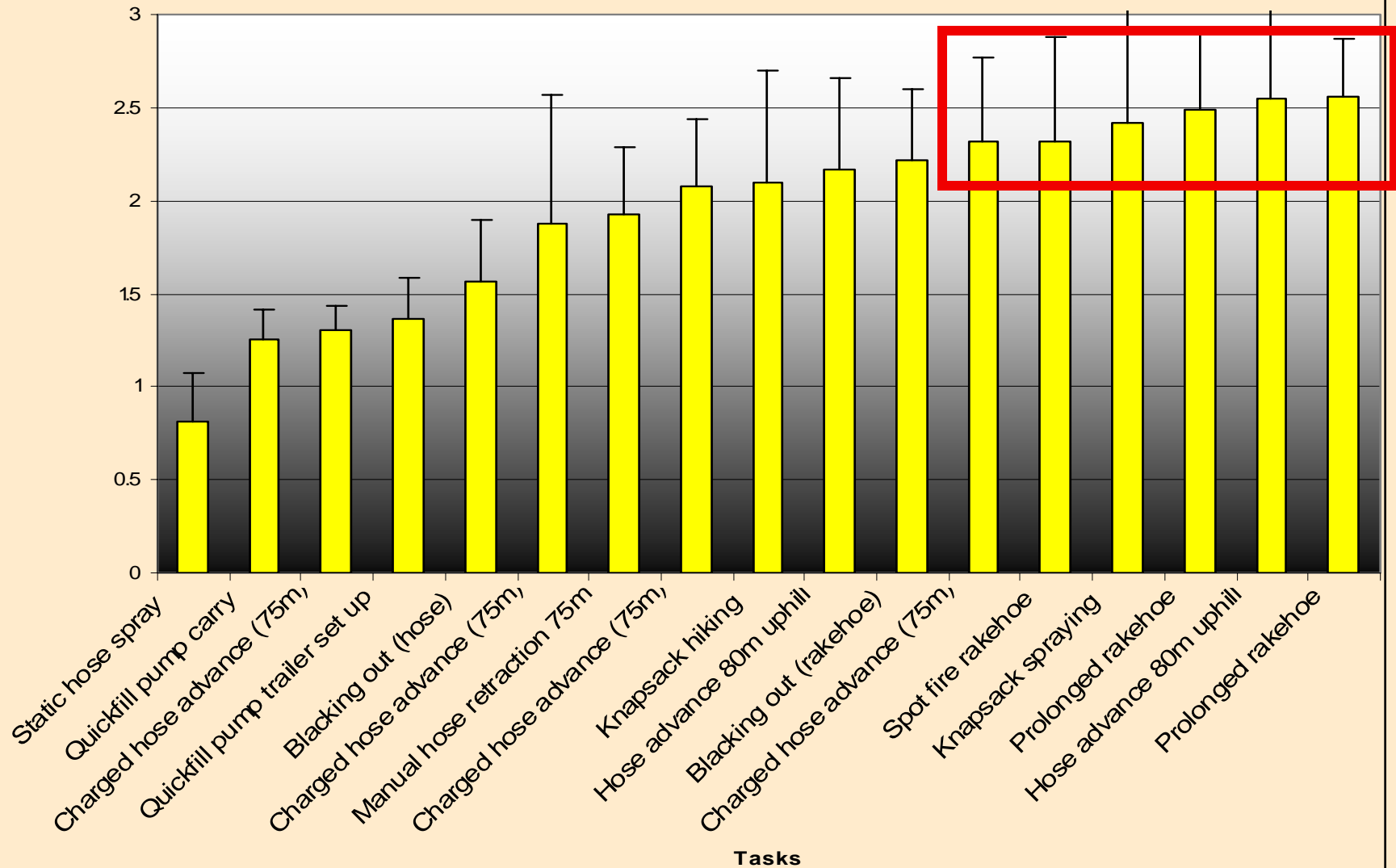
# PART 2: Developing a fit for purpose test

Developing a fit for purpose standard

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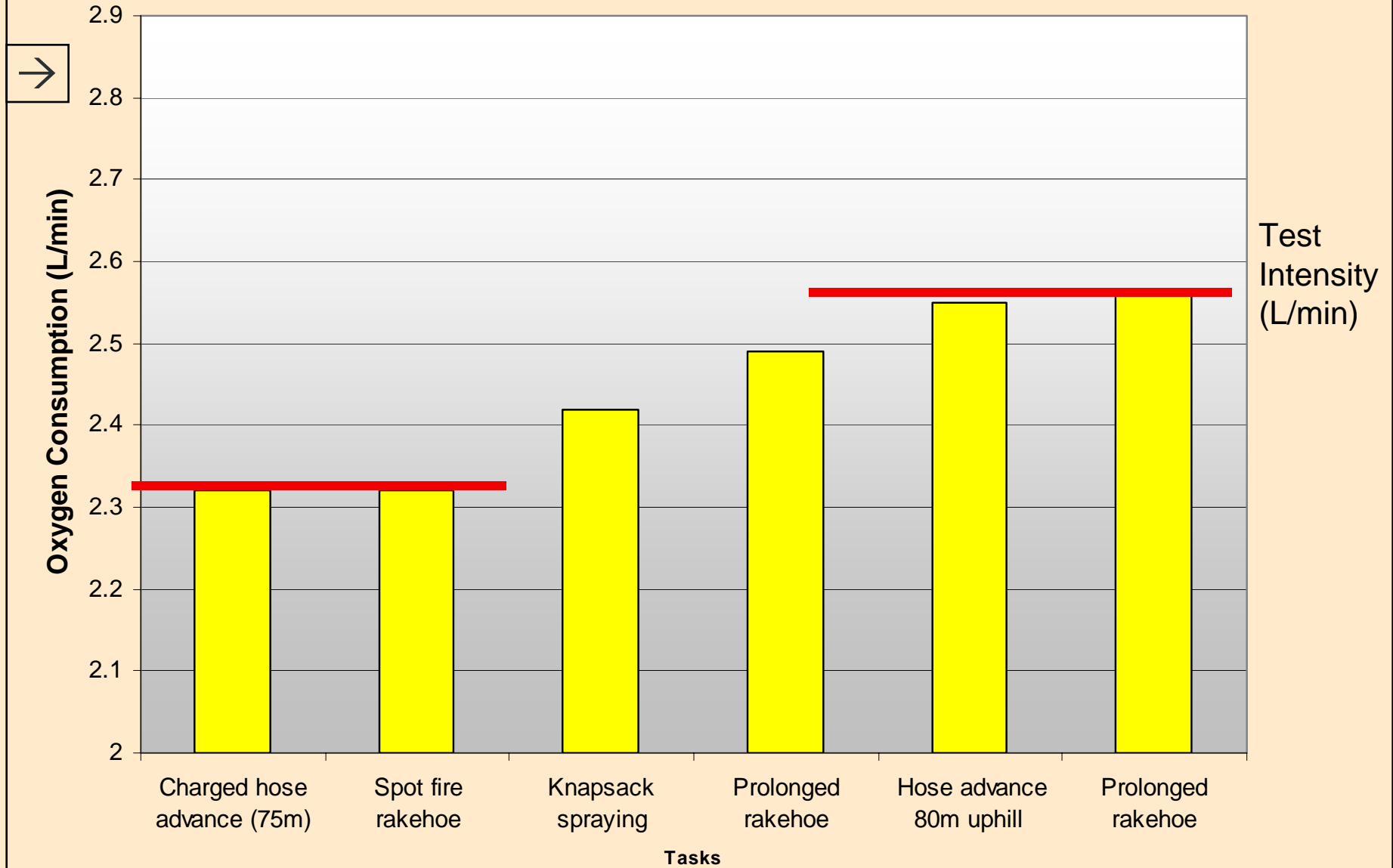
Oxygen Consumption (L/min)



# Developing a fit for purpose test

Developing a fit for purpose standard

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# The Fit for Purpose Test

Developing a fit for purpose standard

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1. Hose Advance
  - Obstacle negotiation
  - Weighed branch



2. Arm Cranking



3. Repeat numerous 'laps' in set time at an intensity matched to metabolic level



**“ Designed for firefighters, developed with firefighters, and tested by firefighters ”**

# This time next year.....



## 1. 'Fit for purpose' prototype:

- Speed
- Weighted branch
- Duration
- Reliability
- Sensitivity



## 2. Extensive fire fighter data on:

- Fitness
- Health
- Operation job test performance

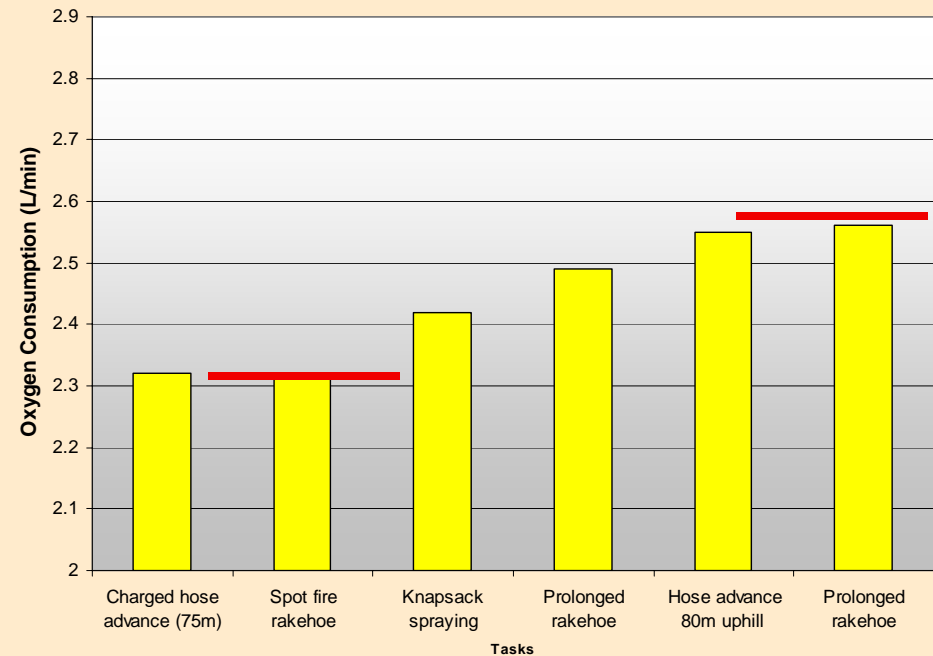
## 3. The standard

- Validated screening protocol for bushfire fighters

# Important considerations for fire agencies:



- Implementation of a fit for purpose standard
  - Safety standard Vs Productivity standard
    - Safety reserves
  - Retention
  - Redistribution into specific roles
  - Campaign fire deployment
  - Who administers the test?
  
- Increased agency participation in development of standard
  - Standard most valid to states that participate



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