

TAKING EXERCISE CONDITIONING PAST CONVENTIONAL BOUNDARIES

Extension of Physical Performance Beyond the Potential of Traditional
Approaches

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GENERAL OVERVIEW

- Focus herein might be considered analogous to a case study on performance
 - The mechanisms of molecular and systemic adaptations would deserve presentations specific to context
- Specific approach herein referenced as Altitude Hypoxia Training (AHT)
 - Distinguish from Intermittent Hypoxia Training (IHT) that has often been used and is more generic

BRIEF BACKGROUND INFORMATION

- Garner, RP, Powers, SK, & Church, G. **Effects of hypoxia and hyperoxia on ventilatory kinetics during recovery from exercise.** *Aviat. Space Environ. Med.* 57: 1165-9, 1986.
- Hudgins, CB, Garner, RP, Mandella, JG & Murphy, RE. **Cognitive performance changes as a result of exposure to various levels of low altitude hypoxia.** *Aviat. Space Environ Med.* 69:238, 1998.
 - Impact of cycle ergometry and altitude exposures of 8-15kft on a cognitive performance test battery.
- **Certification for portable oxygen delivery system using alternative gas delivery technologies.**
 - Proprietary study for certification basis of 787 system (circa 2008) at 13kft and subsequently updated to 14kft in 2018 and 2019. Leveraged exercise responses to altitude as a basis for equivalence.

TRAINING ROUTINES OVERVIEW

- General characterization of workouts or training
 - Physiological adaptation
 - Specificity of training
 - Endurance
 - Strength
- Concept that altitude (hypoxia) exposures can facilitate adaptations

THE EXERCISE AND OXYGEN INDUSTRIES

- Cyclic Variations in Adaptive Conditioning (CVAC)
- Exercise with Oxygen Therapy (EWOT)
- Live O₂, Maxx O₂
- Oxygen Multi-Step Therapy (von Ardenne)
- Various physicians, health/exercise professionals

Common Characteristic: Long on theory and correlational data but short on truly quantitative results

WHAT IS IN THE EVIDENCE

- IHT has become very popular
- Belief that IHT would potentiate greater performance improvements than sea level equivalent training
- “...*functional translation in terms of whole-body performance enhancement is minimal.*”
- Extensive body of research and associated publications

Advancing hypoxic training in team sports: from intermittent hypoxic training to repeated sprint training in hypoxia Faiss R, et al. *Br J Sports Med* 2013;47:i45–i50

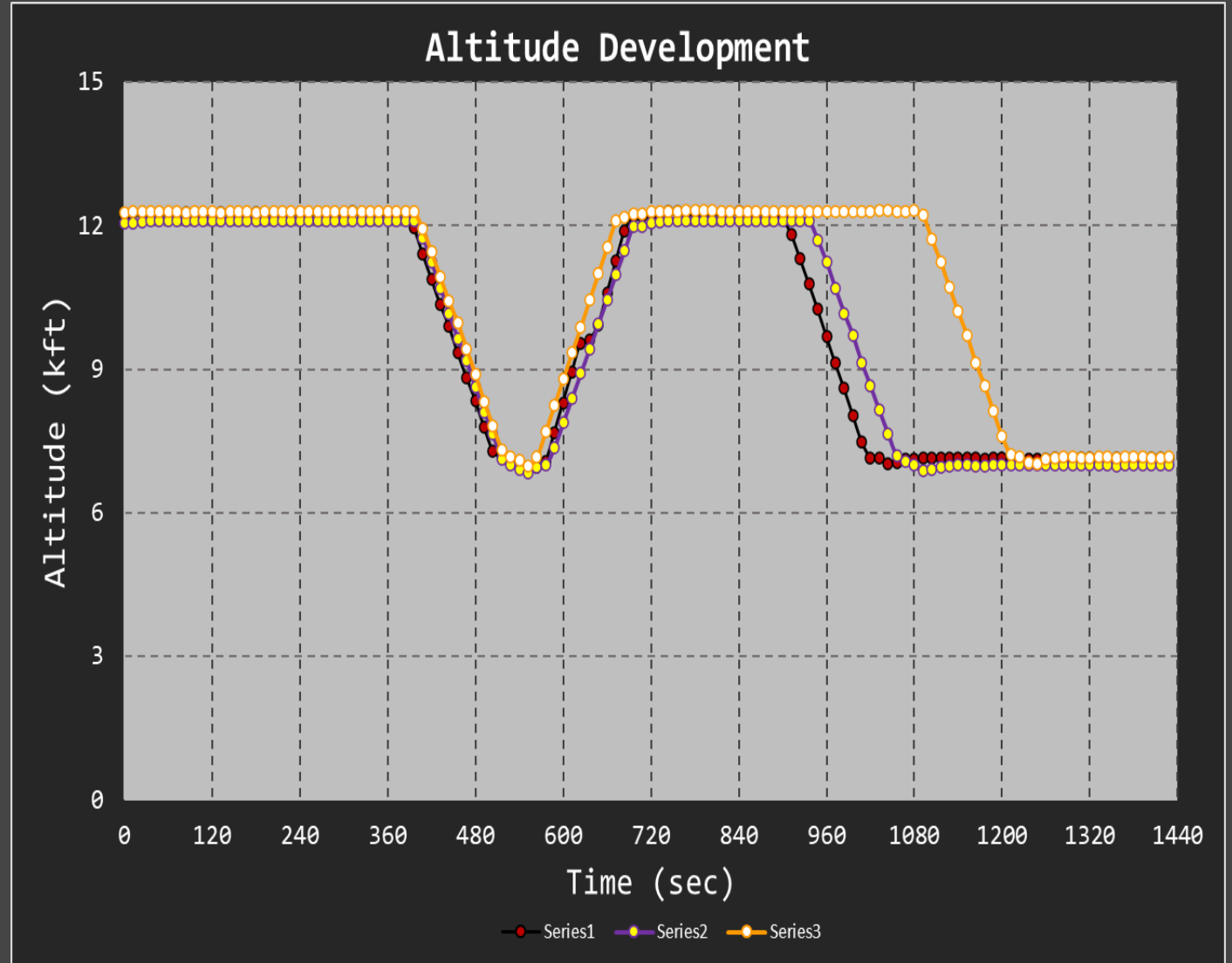
BASIS OF DEVELOPMENTS

- “...*the characteristics of optimal training stimulus in hypoxia are still unclear*”
- The modality is important
 - “*specificity of training*”
- AHT approach built on experience in exercise sciences and human exposure over a range of altitudes (5k-45k feet)
- Leverages variations in workload at altitude as a function of aerobic capacity (V_{O_2} max) and anaerobic threshold (AT)

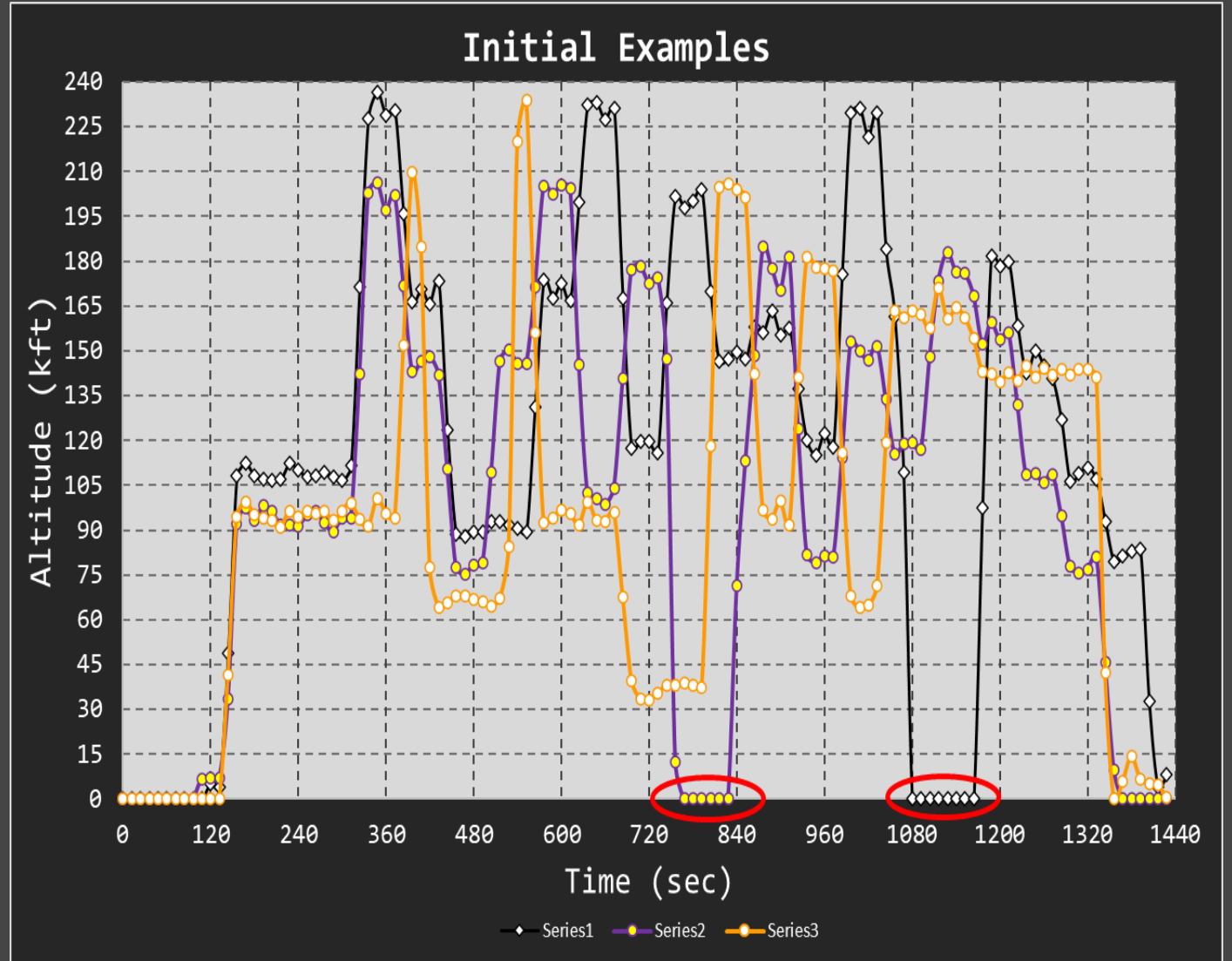
KEY POINTS OF ALTITUDE EXPOSURE

- Minimize known risk factors
 - Barotrauma
 - Decompression Sickness
 - Other Pressure Issues
- Inherently challenging
- Not incapacitating
- Variation presents a complex challenge to elicit stronger adaptive responses
 - Timeframe consistent with allowing feedback and associated responses

THE ALTITUDE EXPOSURE



INITIAL WORK RATE DEVELOPMENT



INITIAL WORK RATE DEVELOPMENT T



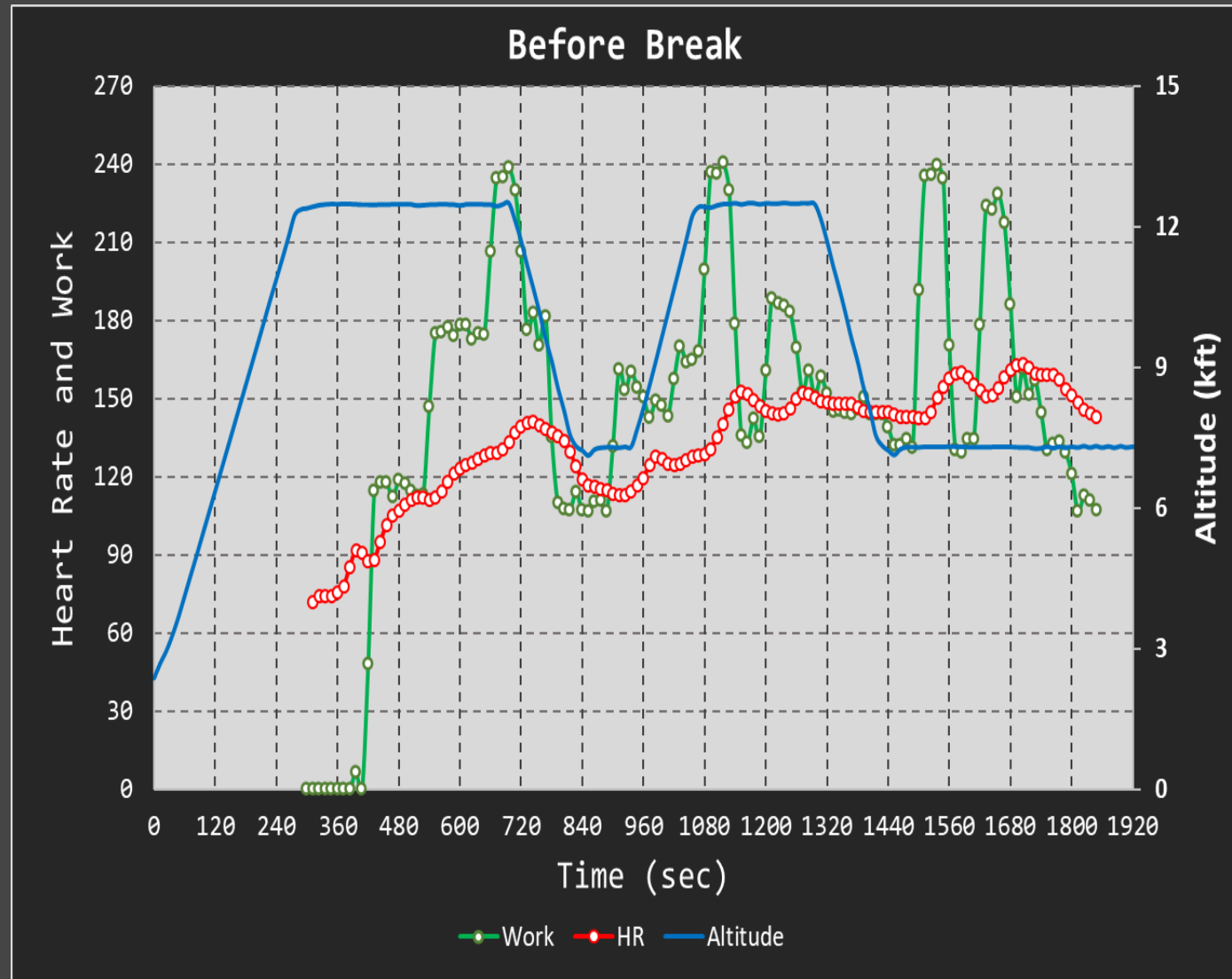
HOW TO DEMONSTRATE EFFECTIVENESS

- Limited resources
 - Number of people
 - Control groups
- Fitness Levels
 - Sedentary: anything elicits improvement
 - Active: interaction of activities
 - Potential synergistic effects
- Highly Trained / Conditioned
 - Harder to elicit changes

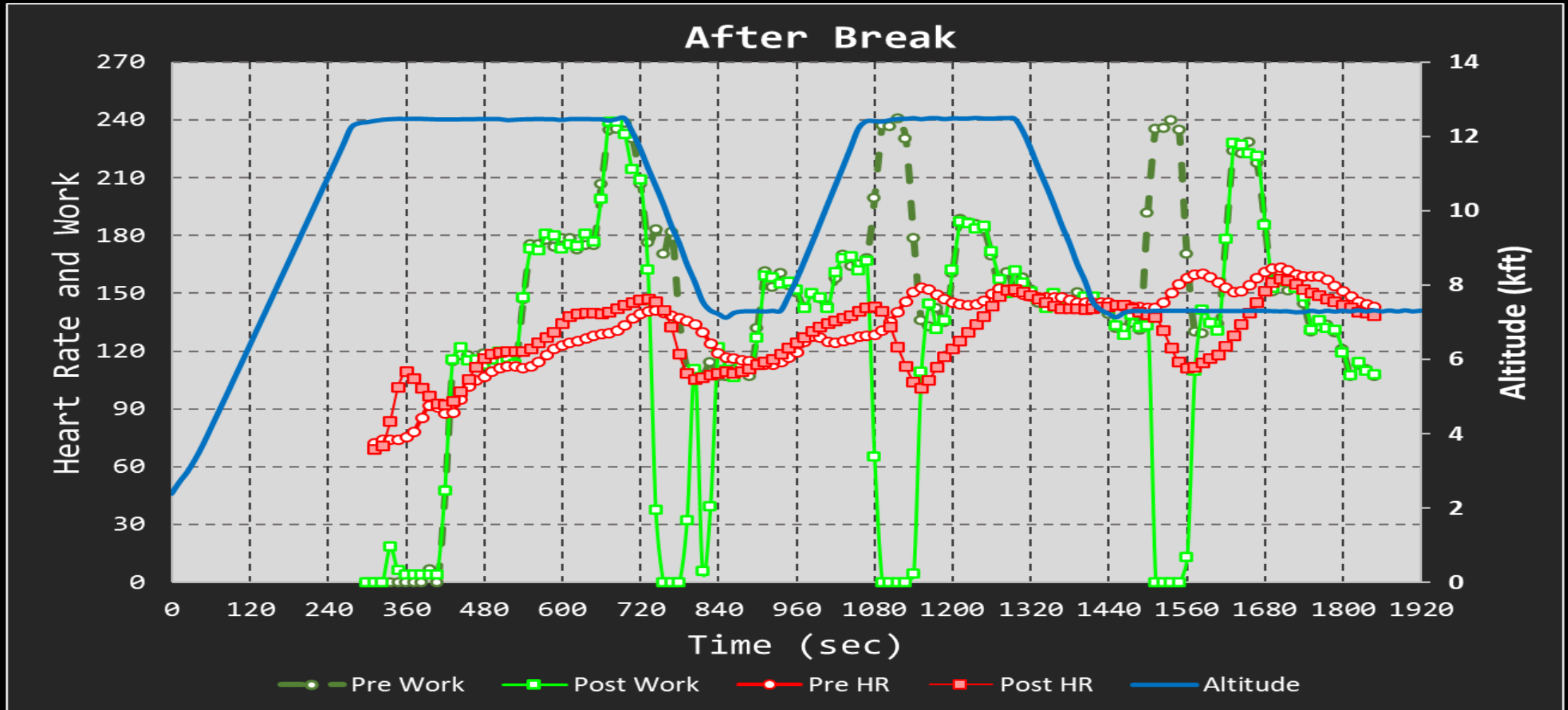
INVESTIGATE OPPORTUNITIES AVAILABLE

- Professional Athlete interested in Altitude Training
 - Competitive heavyweight fighter (8-1)
 - Age 29, 6'2" at 265lb
 - V_{O_2} max 43.2 mlO₂/kg/min
 - AT 27.2 mlO₂/kg/min
- Work rate based on preliminary evaluations
- AHT done in addition to normal training
- Original comparison was going to be magnitude of changes in V_{O_2} and AT before and after training that included AHT²
- Fortuitous
 - AHT break after a few weeks training

INITIAL ALTITUDE TRAINING



RETURN TO AHT



RETURN TO AHT

- Unable to maintain work that was previously able to perform while training under AHT protocol
- Normal training routines associated with professional athletic endeavor continued in interim
- Heart rate response was elevated at identical workloads and altitudes

Suggests that AHT was facilitating performance capabilities beyond what normal training methodologies were eliciting

NEXT STEPS

- Additional people
 - Highly trained
 - Various Fitness Levels
- Specific training regime
 - 2x / week
 - Minimum 2 days between sessions
- Integration or comparison with ongoing training routines
- More precisely characterize performance parameters

PARAMETERS TO MONITOR

- Chamber time and support
 - Sessions take ~1 hour, entry to exit
 - Monitoring, supplies, adjustment over time
- Higher resolution resources for evaluation
 - V_{O_2} max and AT, pulmonary function
- Monitoring during training
 - Respiration
 - Lactate (sporadic)
 - Gas exchange (sporadic)
- Monitoring across training sessions
 - Basic blood markers



QUESTIONS
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