

Zephyr™ PSM Training



Introduction

The Zephyr™ Physiological Status Monitoring (PSM) Training system takes the market leading BioHarness™ technology and integrates it with software that offers team measurement and analysis capabilities. Using heart rate, breathing rate, posture, activity and skin temperature in a single solution gives high visibility and context for performance monitoring and analysis.

PSM Training Applications

With real-time monitoring of up to 64 people simultaneously the PSM Training system offers unparalleled visibility of squads during training, as well as the ability to compare, contrast and analyze performances after the event. Designed for managing multiple subjects, the PSM Training system allows the configuration of hundreds of individuals for data collection, analysis and reporting as part of a team, or individually.

PSM Training Advantage

The comprehensive data gathered combines physiological and motion-based parameters to give context to performance analysis. Zephyr's BioSense™ algorithms combine breathing rate, heart rate and activity monitoring to allow automatic detection of ventilatory threshold and heart rate recovery, while the visibility provided by the whole system also allows simple real-time interpretations for conditions such as dehydration, heat stroke risk, and fatigue.

Who Uses PSM?

PSM Training is used by coaches and athletes in a variety of applications including:

- Defense & First Responder Training & Selection
- Strength & Conditioning
- Soccer
- Football
- Basketball
- Ice and Field Hockey
- Lacrosse
- Biking
- Running
- And Any Endurance or Extreme Sporting Events



Zephyr^{IM} PSM Training



How is PSM Used?

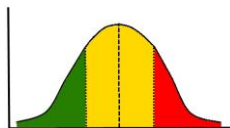
PSM Training helps coaches get the most out of their players. By effectively training with heart rate, breathing rate, activity, skin temperature and posture to manage training intensity and volume of training.

Coaches can execute this in three simple steps:

1. **Baseline** your athletes with any field or fitness test. Use the baseline fitness indicator test results to identify evidence-based training effect in all activities. Repeat the fitness test to gauge candidate improvement.
2. Train with Zephyr's patented **BioGauge™** using Red Orange and Green alarm target zone that use heart rate and breathing rate together as an indicator for proper recovery and work out intensity.

During training activities use PSM technology to monitor stress with Heart Rate, Effort, HRR and HRVT real time indicators. Analysis of parameters such as max heart rate vs. effort; average heart rate vs. effort; activity vs. effort can yield insight into candidates that are "efficient" in their movement and activities versus those that struggle. "Efficiency" – and the lack of it - is not always visible or evident during the training session.

3. Manage training with our **Group Report**. This report captures our robust data in a easy to use method that indicates training effort and training volume in a simple color coded red orange and green system that indicates you're over and underachiever.



Name	Start DateTime	Duration	Effort Avg	HR Avg	HR Max	HRR Avg	BR Avg	Time at VT	Skin Temp Avg	Total Calories
Demo Subject 5	10/11/2008 10:56	0:03:13	3.71	133.83	161	-	32.08	0:02:14	31.30	44
Demo Subject 6	10/11/2008 10:56	0:03:13	7.09	165.78	178	-	38.69	0:02:22	27.35	59
Demo Subject 7	10/11/2008 10:56	0:03:13	7.97	181.59	197	-	39.06	0:02:55	30.43	68
Average			6	160	179	-	37	0:02:30	30	57
Standard deviation			2	24	18	-	4	0:00:22	2	12
SIGNIFICANTLY HIGH:			9	185	197	-	41	0:02:52	32	69
SIGNIFICANTLY LOW:			2	136	161	-	33	0:02:09	28	45
Training Monotony (Mean/STDV)			2.78							

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Training Exercise

More often than not teams train in extreme conditions, 90° F heat stress index environments (ambient temperature plus humidity) or for certain sports extreme cold. Various uniforms ensembles prevent the evaporative cooling effect of airflow across the skin.

Heat injuries are caused by elevated core temperature. This usually results from a combination of work load, ambient temperature, humidity, hydration, conditioning equipment load, uniform (as an insulator), physical condition, and activity. These include previous heat injury, viral infections, sleep deprivation, certain medications (including commonly used non-steroidal anti-inflammatory drugs like ibuprofen) and poor nutrition.

Measurement of body core temperature as an indicator of heat injury is not practical in the field. Indirect measurements of rising core temperature, however, can be made by the BioHarness™ that indicate the body's reaction to elevated core temperature. These indicators can be a predictor of heat injury and include increased heart rate (cardiac drift) increased breathing rate, reduced heart rate recovery, and decreased movement (late in the game).

The BioHarness™ automatically measures Heart Rate Recovery (HRR) for fitness changes long term. Short term (during a single day) changes are primarily due to cardiac drift plus elevated core temperature. Comparison to long term HRR base line is an effective measure of heat stress risk. PSM can determine if a person is exercising or stationary. Combining activity with heart rate allows HRR to be measured. If the HRR is less than the individual's base line then heat injury is likely.


The PSM Training System will give the coach(es) and the physician the actual real time status of the player. Real time PSM can improve the length of training and subsequent effectiveness of the teams. Payback can be quantified through increased player performance; faster recovery, better stamina all focused on the sole objective of winning more competitions.

PSM Training is a one stop solution to monitor and detect your player's wellbeing in the field focusing on training effectiveness and injury prevention; the most common causes associated with heat stress, heat injury, and dehydration.


Zephyr^{IM} PSM Training



PSM Training




Zephyr^{IM} Team System
Get the edge




Zephyr Wrist Modem

¾ mile range 64 person Log or Tx
0.5Hz polling



OmniSense Live



OmniSense Analysis

What's in the box?

The System comprises three building blocks allowing teams to operate independently or as part of a networked force.

- BioHarnessTM: chest strap or shirt
- Long range Antenna or Short Range Z-ModemTM Training Radio
- OmniSenseTM PC software

BioHarnessTM

Components are a BioModuleTM and BioStrapTM (shown) or a BioshirtTM option. Measures:

- EKG
- Heart Rate,
- Breathing Rate
- Temperature (skin)
- Activity (stationary, walking or running)
- Posture (laying or standing)
- Effort, Dehydration, heat stress and risk

Operating Modes:

- Streaming – ISM (or Bluetooth version)
- Logging – Logs data for up to 20 days for post event download



Chest strap

Zephyr™ PSM Training



Charging

The BioModule™ battery is rechargeable and lasts 24hrs. It charges to full capacity in 3hrs and to 90% capacity in 1hr. The chargers are available in:

- Single module configuration or
- Four module configuration

The chargers not only recharge the batteries – they are also used to download log files from the BioModule™ to OmniSense software



Single Module Configuration

Four Module Configuration



Short Range Antenna



Extended Range Antenna

Radio Communications

PSM Training is available in ISM and Bluetooth configurations.

ISM Configuration

The ISM configuration allows users to log data for subsequent review or transmit real time data for live viewing. In logging mode information is stored in the BioModule™ and exported for post event analysis. For real time viewing, ISM can be configured with a short range USB antenna supporting distances up to 30'.

Since most team sports utilize a larger area, an extended range antenna is available supporting distances up to 150'.

Bluetooth Configuration

For communication in training scenarios Zephyr offers the Z-Modem™, which is a short range data radio supporting distances up to 300 yards. In this configuration, one Z-Modem will be required to act as a gateway replacing the tactical radios in the previous scenario.

Direct Bluetooth connection to a laptop or Smartphone can be used for personal viewing or to share over the internet.



Z-Modem

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OmniSense™ Software

PSM Training's data is presented by using Zephyr's OmniSense™ software. There are two applications encompassed by OmniSense™:

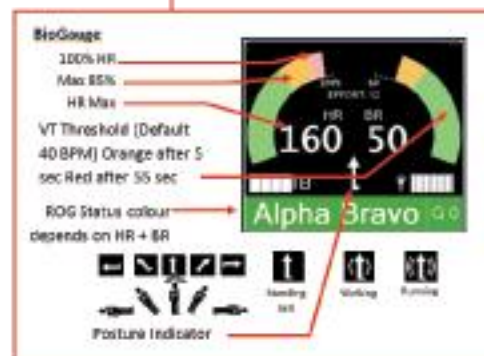
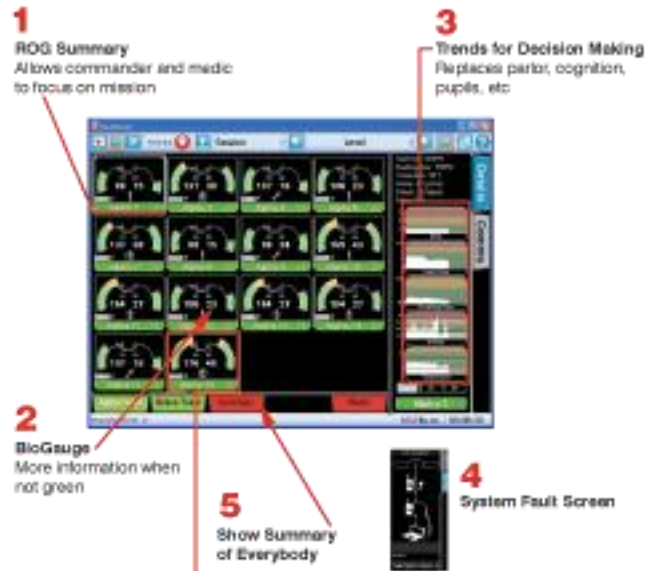
- OmniSense™ Live – Displays real time information on the individual and team's physiological status.
- OmniSense™ Analysis – Used for review and assessment after the completion of a training scenario or live operation.

OmniSense™ Live

Our interface has been designed in conjunction with Academic Researchers and Strength & Training Coaches. A click of icon provides instant access of the entire team's sports readiness.

Easy to interpret screens provide:

- **Summary** screen of the entire team
- **Deployment Tool** to add and organize team members
- **Team** based viewing of operational groups
- **Status** summary for each individual Red-Orange-Green with configurable settings.
- **BioGauge™** view for instantaneous physiology update of individuals.
- **Trends** for time based diagnostic by remote medical personnel



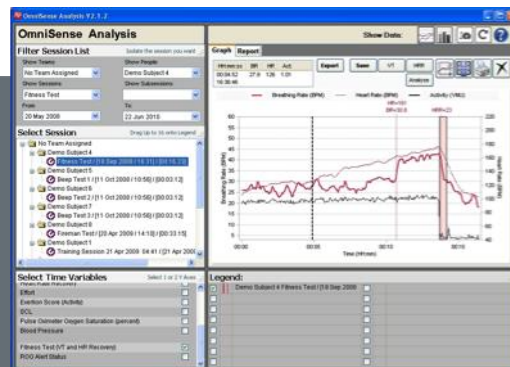
Measures up to 64 People

Zephyr™ PSM Training



OmniSense™ Analysis

- A. Post event software that provides:
- Automatic team fitness assessment of entire team simultaneously in the field
 - Team analysis of a scenario
 - Individual analysis between events over time
 - Auto update of personnel baseline information
 - After action reviews
- B. Fitness Test
- Used to perform a baseline measurement of team members
 - Import actual data – Max heart rate, breathing rate, heart rate recovery and a myriad of other important personal parameters
- C. Reports
- Training time
 - Red-Orange-Green heart rate zones
 - Heart rate maximum
 - Heart and breathing rate
 - Effort
 - Group fitness



The screenshot displays the OmniSense Analysis software interface, showing a table of session data. The table has columns for "Name", "Date", "Time", "Heart Rate (BPM)", "Breathing Rate (BPM)", "Max HR", "Max BR", "Max HR/HR", and "Max BR/BR". The data is organized into a "Sessions" table and a "Summary" table. The "Sessions" table lists individual sessions for various subjects, including "Demo Subject 5", "Demo Subject 6", "Demo Subject 7", and "Demo Subject 8". The "Summary" table provides statistical data for the sessions, including "Standard deviation", "SIGNIFICANTLY Y PROB:", "SIGNIFICANTLY X CORR:", and "Training Memory (Mean/STDEV)".

Name	Date	Time	Heart Rate (BPM)	Breathing Rate (BPM)	Max HR	Max BR	Max HR/HR	Max BR/BR
Demo Subject 5	10/13/2008	10:56	180	25	180	25	1.00	1.00
Demo Subject 6	10/13/2008	10:56	180	25	180	25	1.00	1.00
Demo Subject 7	10/13/2008	10:56	180	25	180	25	1.00	1.00
Demo Subject 8	4/20/2009	14:10	180	25	180	25	1.00	1.00

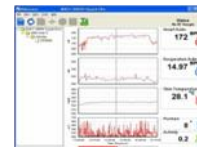
Statistic	Value
Standard deviation	35, 22, 17, -
SIGNIFICANTLY Y PROB:	0.01, 0.01, 0.01, -
SIGNIFICANTLY X CORR:	0.99, 0.99, 0.99, -
Training Memory (Mean/STDEV)	180/35, 25/22, 170/17, -

Zephyr[™] PSM Training



PSM Product Catalog

PSM Research



50 ft range 1 person Log or Tx
120Hz Streaming

Research Waveforms e.g. EKG

PSM Training



Zephyr Wrist
Modem



300 yard range 64 person Log or Tx
0.5Hz polling

OmniSense Live & Analysis

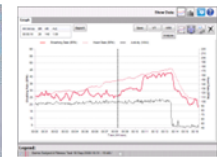
PSM Responder



MOTOROLA
XTS Radio



Bluetooth
Radio Interface Device



2 miles range 64 person Log OR Tx
15 sec polling

OmniSense Live & Analysis
Log and Tx: device transmits and logs to memory all the time

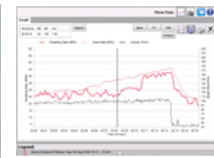
PSM Defense



TYPE 1
Tactical radio



Bluetooth / Wired
Radio Interface Device



2 miles range 64 person Log OR Tx
15 sec polling

Tactical radios are voice priority. Data delay may occur on some models

Zephyr[™] PSM Training



BioHarness[™] Bluetooth Module

PARAMETER	SPECIFICATION
Heart Rate:	25 – 240 Beats per Minute \pm 1 BPM
Breathing Rate:	3 – 70 Breaths per Minute
Skin Temperature:	10 – 60 °C \pm 0.2°C in range 30 - 40°C
Battery Duration:	24 hrs Standby Mode, 18 hrs Active Mode
Charge Time:	3 hours to 100%, 1 hour to 90%
Battery Life:	Capacity 80% after 300 deep discharge cycles (4500hrs of use)
Storage Life:	6 months between charges (for optimal – recharge monthly)
Strap Sizes:	XS (22 – 26”), S (26 – 32.5”), M (32.5 – 39”), L (39 – 45.5”), XL (45.5 – 52”)
Strap Washing:	Remove Device.
Wash durability:	Typically 150 washes
Environmental-Operating	
Humidity:	5 - 90 %RH
Temperature:	-10 - 50°C
Environmental – Storage:	
Humidity:	5 - 90 %RH
Temperature (< 1 month):	(Power off) -20 - 45°C
Temperature (< 6 months):	(Power off) -20 - 35°C
Water Resistance (Device):	Splash Proof
Bluetooth Compliance:	Version 2.0 + EDR
Operating Frequency:	2.4 - 2.835 GHz
Output Power:	2 mW
Regulatory Approvals	FCC Part 15 Subpart C FDA - Pending CE - Pending

ZephyrTM PSM Training



Zephyr Background

Zephyr Technology is a global leader in real-time performance and biomechanical monitoring or "Physiological Status Monitoring" (PSM) solutions for Defense, First Responder, Training and the Academic Research markets. Zephyr Technology leverages a world class team of engineers, scientists, physiologists and business experts.

Founded in 2003, Zephyr Technology has been a pioneer in the use of PSM in training and high stress operational environments. The company's ongoing collaboration with fire departments, NASA Ames Research Center, National Guard Civil Support Teams, and US Special Operations Forces has been invaluable in the development and validation of Zephyr's technology and its application in the most extreme operating environments to

Measure Life . . . Anywhere

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