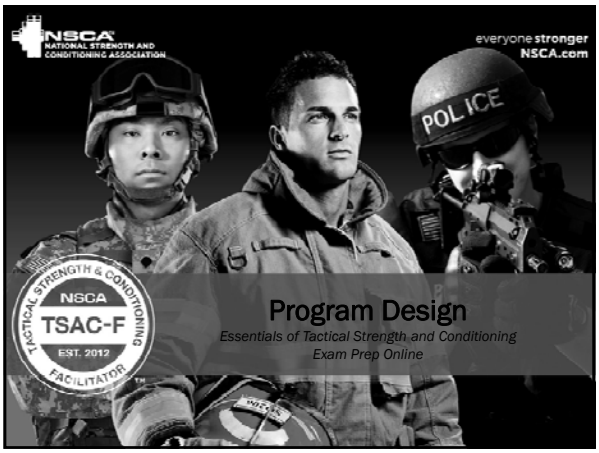


Copyright

Content Weighting

Program Design Topic Areas	RE	AP	AN	Total
Basic Program Design	2	4	10	**16**

Key Training Principles

Topics

- Identify the key training principles applicable to program design
- Outline steps for designing an aerobic training program

Training Principle #1: Specificity

- S.A.I.D. Principle - Specific Adaptations to Imposed Demands
  - The type of demand placed on the body dictates the adaptation
- Target/goal
  - Energy system
    - Aerobic
    - Anaerobic

Specificity cont.

- Desired activity
  - Swimming, running, climbing, jumping
  - Moving/carrying heavy loads
- Muscle actions/groups
  - Pushing activities; legs, chest, anterior shoulders
  - Pulling activities; legs, back, posterior shoulders
- Movement specificity/patterns
  - Canine officers lifting dogs up into a window
  - Hose drag


Training Principle #2: Overload

- Overload
  - Training intensity is greater than what the individual's body is accustomed to
  - The body will respond by adapting
- Overload variables
  - Intensity
    - Resistance training – ↑ load or ↓ rest period
    - Speed/agility or aerobic – ↑ effort


Overload cont.

  - Duration
    - Resistance training – ↑ sets/reps or number of exercises
    - Speed/agility or aerobic – ↑ duration/distance
  - Frequency
    - Increase number of training sessions per day or per week
  - Complexity
    - Resistance training
      - Machines → Free weights
      - Single-joint → Multi-joint
    - Speed/agility or aerobic – skill specific

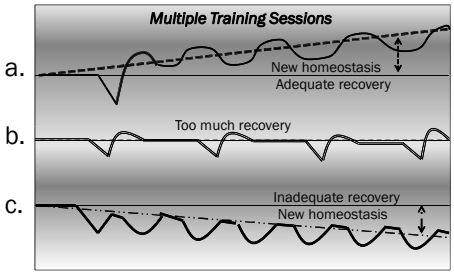
**Manipulate only one variable at a time to reduce the risk of overtraining*


Overload cont.

General Adaptation Syndrome (GAS)

- Shock or alarm phase
  - Soreness, stiffness, decreased performance
- Resistance phase/supercompensation
  - Body resists the shock phase
  - Neural and muscle tissue adaptations
- Exhaustion phase/overtraining
  - Inability to handle workload/stress
  - Staleness and overtraining

Overload vs. Overtraining



Training Principle #3: Progression

- Progression
  - Gradually and consistently overload the body over time
  - Lack of progression leads to “plateau”
- Progressive overload
  - Systematic increase in training frequency, volume, and intensity in various combinations
  - As intensity increases, volume decreases

Training Principle #4: Variation

- Lack of variation can lead to "monotonous overtraining" or decreases in strength and power
  - Less variation required for novice lifter as compared to advanced lifter
- Variation options
  - Frequency
  - Intensity
  - Volume
  - Rest intervals
  - Within a workout, during the week, or over several weeks

Topics

- Aerobic performance factors
- Lactate threshold and OBLA
- Steps to designing an aerobic endurance program

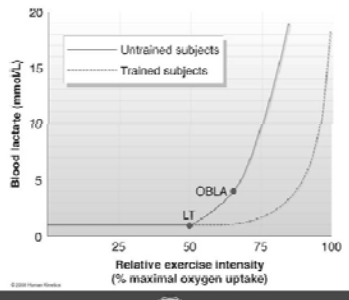
Aerobic Performance Factors

- Maximal aerobic power (VO_2max)
  - High correlation between VO_2max and aerobic performance
- Lactate threshold
  - % of VO_2max at which blood lactate begins to accumulate
  - Solid performance predictor with similar VO_2max levels
- Exercise economy
  - Measure of energy cost at a given exercise velocity

Lactate Threshold and OBLA

- Lactate threshold (LT)
  - Lactate rises above resting levels
  - Represents a reliance on anaerobic mechanisms
  - Begins earlier for untrained athletes (50-60%) as compared to trained athletes (70-80%)
- Onset of blood lactate accumulation (OBLA)
  - Lactate accumulation at 4 mmol/L
- Indicate Type II muscle fiber recruitment

Lactate Threshold and OBLA



Aerobic Endurance Programming

Program design steps

1. Mode
2. Frequency
3. Intensity (work load)
4. Duration (volume)
5. Progression


Step 1: Training Mode

- Refers to the specific type of training activity
  - Match the demands of the job-task requirements
  - Consider current training status and injuries
    - If a tactical athlete has low back pain, select alternative conditioning methods (swimming as opposed to running)


Step 2: Frequency

- Training frequency (number of workout sessions per week) depends on:
  - Current training status
  - Time available to train
    - Does the tactical athlete have to be ready immediately or do they have 4 months to prepare (i.e., before deploying)?
  - Intensity and duration
    - How long will it take the tactical athlete to recover from the workouts?
  - Concurrent training
    - Will the tactical athlete be training lower body strength or job-specific training?

Beginner		Intermediate		Advanced
5 days rest	4 days rest	3 days rest	2 days rest	1 day rest
2 days exercise	3 days exercise	4 days exercise	5 days exercise	6 days exercise


Step 3: Training Intensity

- ↑ intensity = ↓ duration
- Training intensity must create an overload in order to induce performance enhancements
- Methods for determining training intensity:
  - Percentage of VO_2max
  - Target heart rate
    - Karvonen formula – uses heart rate reserve (HRR)
      - Most frequently used; correlates well to % of VO_2max
    - % of maximal heart rate (MHR)

Prescribing Aerobic Intensity

Determining target heart rate:

- Option 1: Maximal heart rate (MHR) method
  - 220 – age = MHR
  - % of exercise intensity x MHR = Target heart rate (THR)
- Option 2: % heart rate reserve (HRR) method
  - MHR – resting heart rate (RHR) = Heart rate reserve (HRR)
  - (% of exercise intensity x HRR) + RHR = THR

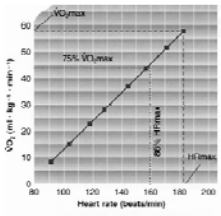
Examples of Calculations

Tactical athlete: 40 y.o., RHR = 80 bpm, intensity = 70%

Max Heart Rate	Heart Rate Reserve
• MHR = 220 – 40 = 180 bpm • 180 x 0.70 = ***126*** bpm • 180 x 0.85 = ***153*** bpm Target heart rate = ***126*** *bpm*	• APMHR : 220 – 40 (age) = 180 bpm • HRR: 180 – 80 bpm (RHR) = 100 bpm • 100 x 70% = 70 bpm • 70 + 80 (RHR) = ***150*** bpm Target heart rate = ***150*** bpm

VO_2 and HR Relationship

% VO_2 max	% HRR	% MHR
50	50	66
55	55	70
60	60	74
65	65	77
70	70	81
75	75	85
80	80	88
85	85	92
90	90	96
95	95	98
100	100	100



** %HRR and % VO2 max are highly correlated*

*** Exercising at a certain %MHR is NOT the same as exercising at the same %HRR*

Metabolic Equivalents (METs)

- METs – amount of O_2 required by the body to function at rest
  - 1 MET = 3.5 ml/kg/min
  - An activity with a 4-MET rating is four times harder than at rest

Step 4: Duration

- Duration/intensity relationship
  - Longer duration requires decreased exercise intensity
- Considerations
  - Time constraints
    - Influences duration and frequency of exercise
    - Typical range: 20-60 min
  - Initial goals
  - Undue fatigue/injury
    - Negate increases in exercise duration

Step 5: Progression

- ↑ duration = ↓ intensity (or vice-versa)
  - Do not progress intensity and duration at the same time
- Progression
  - Frequency, intensity, duration
  - Do not increase more than 10% each week
  - Include at least 1 rest day per week

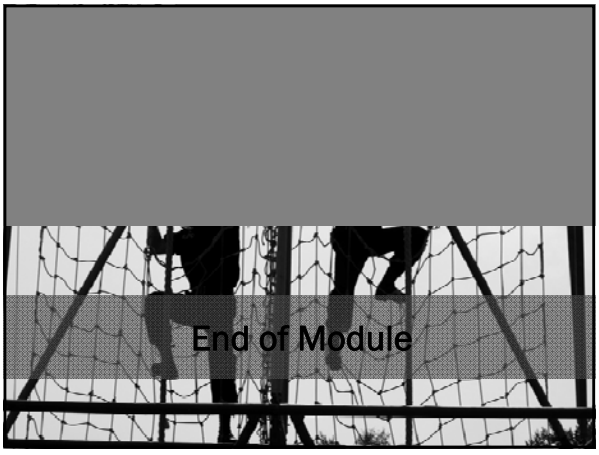
everyone**stronger**
NSCA.com

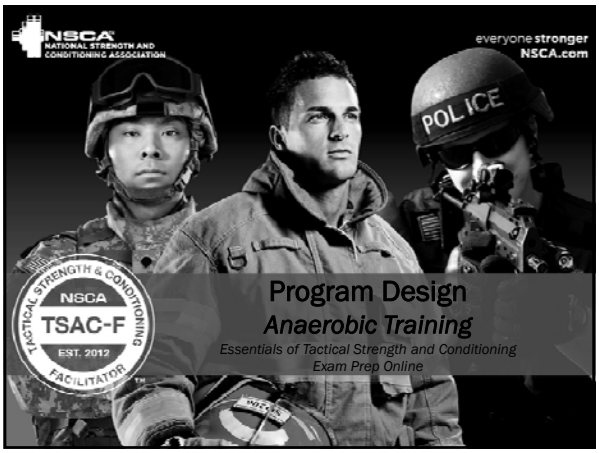
Aerobic Training Progressions

Maximal Oxygen Uptake Rate	Fitness Classification	Exercise Intensity	Exercise Duration	Exercise Frequency
≤34 ml/kg/min	Low	60-70% of MHR 50-60% of HRR 50-60% of VO_2 max RPE = 11-13 (fairly light to somewhat hard)	20-30 minutes per session	3 days per week
35-49 ml/kg/min	Moderate	70-80% of MHR 60-75% of HRR 60-75% of VO_2 max RPE = 13-15 (somewhat hard to hard)	30-45 minutes per session	4 days per week
≥50 ml/kg/min	High	80-90% of MHR 75-85% of HRR 75-85% of VO_2 max RPE = 15-17 (hard to very hard)	45-60+ minutes per session	5 days per week

NOTE: the VO_2 max values above are for a 25 year old male; subtract 5 ml/kg/min for a comparable value for a female (of the same age)

everyone**stronger**
NSCA.com





Copyright

Content Weighting

Program Design Topic Areas	RE	AP	AN	Total
Basic Program Design	2	4	10	**16**

Topics

- Identify the components of a resistance training program
- Steps for designing a resistance training program

Steps to Designing a Resistance Training Program

1. Needs analysis
2. Exercise selection
3. Training frequency
4. Exercise order
5. Training load and repetitions
6. Volume
7. Rest periods
8. Sequencing

Step 1: Needs Analysis

Consists of two parts:

1. Evaluation of physical demands of job
2. Assessment of tactical athlete

The resistance training goal is a result of the evaluation of the physical demands of the job and assessment of the tactical athlete

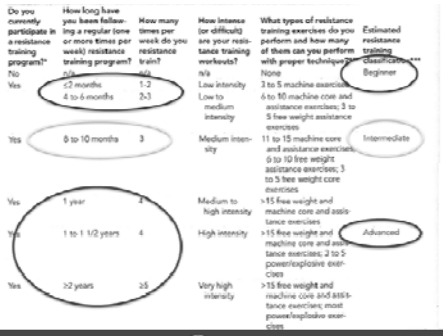
Evaluation of Physical Demands

- Movement analysis
  - Body and limb patterns, muscular involvement, flexibility demands
- Physiological analysis
  - Strength, power, hypertrophy, and muscular endurance priorities
- Injury analysis
  - Common injury sites and causative factors

Assessment of Tactical Athlete

- Training status
  - Current condition, training background, health status (next slide)
- Physical testing and evaluation
  - Strength, power, flexibility, speed, muscular endurance, body composition, cardiovascular endurance, other

Training Status



Do you currently participate in a resistance training program?*	How long have you been following a regular (one or more times per week) resistance training program?	How many times per week do you resistance train?	How intense (or difficult) are your resistance training workouts?	What types of resistance training exercises do you perform and how many of them can you perform with proper technique?**	Estimated resistance training classification***
No	n/a	n/a	n/a	None	Beginner
Yes	<2 months	1-2	Low intensity	2 to 5 machine exercises	
	4 to 6 months	2-3	Low to medium intensity	6 to 10 machine core and assistance exercises; 3 to 5 free weight assistance exercises	
Yes	8 to 10 months	3	Medium intensity	11 to 15 machine core and assistance exercises; 6 to 10 free weight assistance exercises; 3 to 5 free weight core exercises	Intermediate
Yes	1 year	3	Medium to high intensity	>15 free weight and machine core and assistance exercises	
Yes	1 to 1 1/2 years	4	High intensity	>15 free weight and machine core and assistance exercises; 2 to 5 power/explosive exercises	Advanced
Yes	>2 years	≥5	Very high intensity	>15 free weight and machine core and assistance exercises; most power/explosive exercises	

Step 2: Exercise Selection

- Exercise type
  - Core (large muscle/multi-joint) exercises
    - Structural (spinal/axial loading)
    - Power (explosive movements) exercises
  - Assistance (smaller muscles/single-joint) exercises
- Work demand-specific
  - Specificity – exercises that mimic activities
    - Firefighter climbing stairs in full gear
  - Muscle balance; agonist vs. antagonist

Exercise Selection cont.

- Other
  - Exercise technique experience
  - Availability of equipment
    - Training facility
    - In the field
  - Training time per session
  - Injury concerns

Step 3: Training Frequency

- Factors
  - Training status
  - Time of year/training schedule
    - In the field, deployment, intermittent
  - Training load and exercise type

Training Status	Frequency
Beginner	2-3 times/week
	1-3 days between workouts; not more than 3
Intermediate	3 times/week with total body
	4 times/week with split routine
Advanced	4-6 times/week
	Split routine, 3 days "on" and 1 day "off"

Step 4: Exercise Order

- Power
  - Snatch, cleans, push jerk
- Core exercises
  - Squat
  - Bench press
- Assistance exercises
  - Arm curls, standing calf raise

Step 5: Training Load

- Load refers to the amount of weight assigned to an exercise set
- Training load determination
  - Strength, power, etc.
    - Calculated based on % of 1RM
  - Repetition goal
  - Core vs. assistance exercise
    - Assistance exercises are typically <70% 1RM, >10 reps

Load Assignments

Goal	Load (% 1RM)	Reps
Muscular endurance	≤67%	≥12
Hypertrophy	67-85	6-12
Strength	≥85	≤6
Power: Single effort*	80-90	1-2
Power: Repeat effort**	75-85	3-5

*Single effort = single effort during an event
**Repeat effort = multiple efforts during an event

Training Load cont.

- Variation of training load
  - Heavy vs. light days
  - Reduces risk of overtraining
- Progression
  - 2 for 2 rule

Step 6: Training Volume

- Load volume refers to the total amount of weight lifted in a training session
  - Factors in sets
    - Dependent upon training goal
  - Sets x reps x weight
- Multiple vs. single sets
  - Single sets: Applicable for novice
  - Multiple sets: Superior for strength development

Training Volume cont.

Goal	Load (%1RM)	Reps	Sets
Muscular endurance	≤67%	≥12	2-3
Hypertrophy	67-85	6-12	3-6
Strength	≥85	≤6	2-6
Power: Single effort	80-90	1-2	3-5
Power: Repeat effort	75-85	3-5	3-5

Step 7: Rest Periods

- Length of rest period is dependent on:
  - Training goal
  - Relative load lifted
  - Training status

Goal	Rest	Rationale/Purpose
Muscular endurance	≤30 s	Repeated metabolic stress
Hypertrophy	30-90 s	Repeated structural/metabolic stress
Strength	2-5 min	Neuromuscular/structural aspects
Power	2-5 min	Neuromuscular aspects

Step 8: Sequencing Training

- Sequence complimentary training to optimize efforts
  - Goal: Maximum strength
    - Hypertrophy → Strength
      - Increased cross-sectional area will improve max strength gains
  - Goal: Power development
    - Hypertrophy → Strength → Power

General rule: All tactical athletes should start with muscular endurance or hypertrophy to develop a foundation for further training

Topics

- Identify the components of a plyometric training program
- Steps for designing a safe and effective plyometric training program

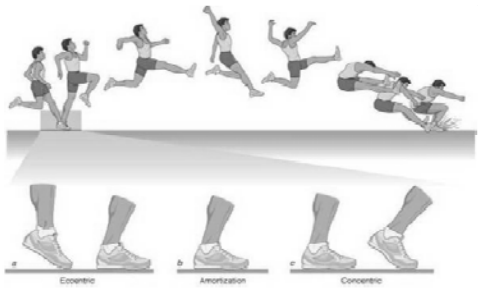
Plyometric Training

- Goal is to increase the power of a movement by using the elastic qualities of a pre-stretch and the stretch reflex
  - Involves the stretch-shortening cycle (SSC)
    - Eccentric phase
    - Amortization phase
    - Concentric phase

Plyometric Training cont.

Phase	Action	Physiological Event
Eccentric	Stretch of the agonist muscle	Elastic energy is stored Muscle spindles are stimulated Signal is sent to the spinal cord
Amortization	Pause	Nerves synapse in spinal cord Signal is sent to stretched muscle
Concentric	Shortening of agonist muscle	Elastic energy is released Stretched muscle is stimulated by the nerve

Plyometric Training cont.



Plyometric Training cont.

- Benefits
  - Improved work performance when running, jumping over or onto objects, or changing direction quickly
  - Increased muscle recruitment and strength
  - Increased body control and balance
  - Decreased incidence of injury
  - Improved bone mineral content

Plyometric Program Design

- Training considerations
  - Age: ↓ intensity and volume, ↑ recovery
  - Bodyweight: ↓ intensity
  - Training level: base strength, speed, and balance
  - Proper technique
  - Training surface: shock-absorbing, grass, mats
  - Footwear: good ankle and foot support, non-slip sole

Plyometric Technique

Program Design Variables

- Mode
- Intensity
- Frequency
- Recovery
- Volume
- Program length
- Progression

Mode

- Lower body plyometrics
  - Jumps in place: Tuck jump, squat jump
  - Standing jumps: Jump over barrier
  - Multiple hops and jumps: Zigzag hop
  - Bounds: Single-leg, double-leg, or alternating
  - Box drills: Single-leg, double-leg, or alternating
  - Depth jumps: One or both legs, varied heights

Mode cont.

- Upper body plyometrics
  - Medicine ball throws
  - Push-ups
  - Catches
- Trunk plyometrics
  - Medicine ball sit-ups

Intensity

- Various factors
  - Points of contact: single-leg vs. double-leg
  - Speed
  - Height of the drill: Higher COG, greater landing force
  - Bodyweight: Greater weight = more stress
- Increased intensity = decreased volume

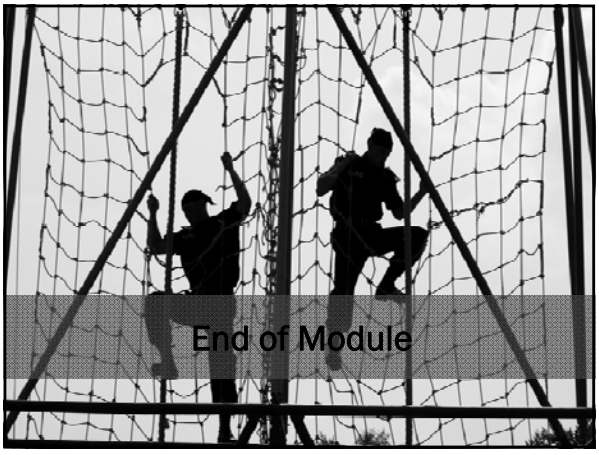
Recovery and Volume

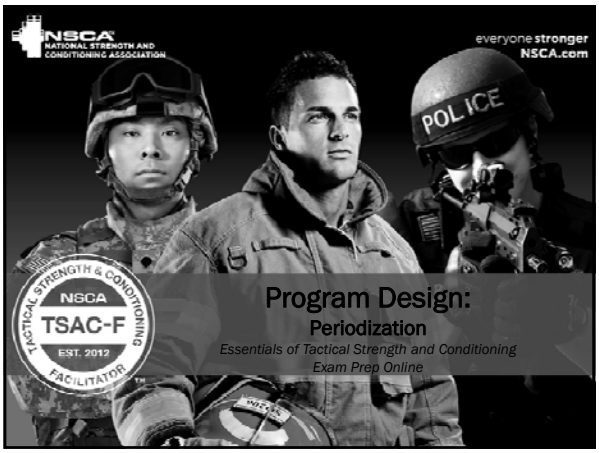
- Recovery
  - Work-to-rest ratio for power
    - 1:5 to 1:10
  - Between workouts
    - 2-4 days
- Volume
  - Number of repetitions and sets
  - Foot contacts per workout

Experience	Volume
Beginner	80-100
Intermediate	100-120
Advanced	120 -140

Program Length and Progression

- Program length
  - Typically 6 to 10 weeks
- Progression
  - Systematic increase in frequency, volume, and intensity
  - Increase training variables independently not simultaneously
- Warm-up is necessary





Copyright

Content Weighting

Program Design Topic Areas	RE	AP	AN	Total
Basic Program Design	2	4	10	**16**

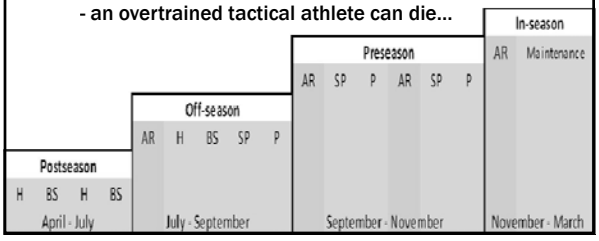
Topics

- Periodization basics
- Various models of periodization and their purposes
- Applicable variations of periodized programs

Periodization

"…intensity, volume, and specificity of training are manipulated over time…"

- an overtrained athlete doesn't perform well…
- an overtrained tactical athlete can die…



Periodization Basics

- Method of program design that is:
  - Preplanned
  - A sequential manipulation of:
    - Intensity
    - Volume
    - Frequency
    - Training focus
    - Exercise selection
  - Organized in periods or cycles


Periodization Basics cont.

- Inclusive – workloads from all training factors should be managed:
  - Aerobic endurance, speed and agility, plyometrics
  - Most widely used with resistance training program design
- Benefits
  - Greater changes in strength, body composition, and motor performance
  - Decreases physical adaptations and plateaus
  - Reduces risk of overtraining


Periodization Basics cont.

Periodization Cycles

- Macrocycle
  - 1 to 4 years
- Mesocycle
  - Weeks to months
  - 2 or more within a macrocycle
- Microcycle
  - 1 to 4 weeks
  - 2 or more within a mesocycle

Periodization Periods

- Preparatory period
  - Hypertrophy/endurance phase
  - Basic strength phase
  - Strength/power phase
- First transition period
- Competition period
- Second transition period
  - Active rest


Preparatory Period

- Develop general/base conditioning
  - Hypertrophy/endurance phase
    - 50-70% 1RM; 3-6 sets, 10-20 reps (low intensity, high volume)
  - Basic strength phase
    - 80-90% 1RM; 3-5 sets, 4-8 reps (high intensity, moderate volume)
  - Strength/power phase
    - 75-95% 1RM; 3-5 sets, 2-5 reps (high intensity, low volume); *progress to more task-specific training*

First Transition Period

- Break between preparatory and competition periods
- One week of lower intensity and/or lower volume training

Competition Period

- Task-specific strength and power and/or maintenance
  - >92% 1RM, 1-3 sets, 1-3 reps(high intensity, low volume)
  - Maintenance: 80-85% 1RM, 2-3 sets, 6-8 reps
  - Depends on needs and schedule
- Consider
  - Firefighters responding to a call vs. infantry leaving for deployment

Second Transition Period

- Commonly called:
  - Unloading week
  - Active rest
  - Restoration
- 1 to 4 weeks
- Unstructured, non-sport specific recreational activities
- Low intensities with low volume

Periodization Models

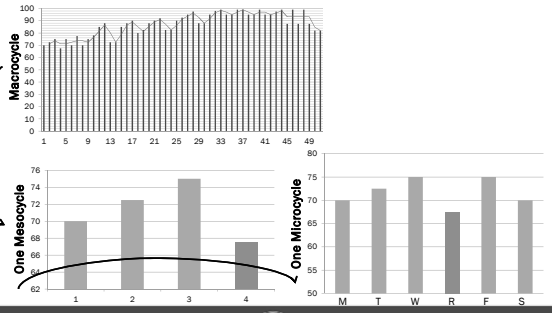
- Models
  - Linear (traditional)
  - Non-linear (undulating)
  - Block
- Determinants for selection
  - Goals
  - Work schedule

Linear Periodization

- Progressive increase in intensity with decrease in volume over time
- Best with specific event dates and single training objectives (e.g., high jump)

Monday	Wednesday	Friday
Heavy	Light	Medium
6 x 2 of 1RM	6 x 2 (80% of heavy day)	6 x 2 (90% of heavy day)

Linear Periodization



Non-Linear Periodization

- Large, daily fluctuations in intensity and volume within a microcycle
- Best with multiple training goals and NO clear event date (e.g., first responder)
- Works on multiple training factors simultaneously
  - May be superior to linear periodization for tactical athletes with no set schedule
  - Less accumulated fatigue within phases

Monday	Wednesday	Friday
4 x 6 of 1RM	3 x 10 of 1RM	5 x 3 of 1RM

Block Periodization

- Uses three specialized mesocycle blocks, each with a specific targeted outcome

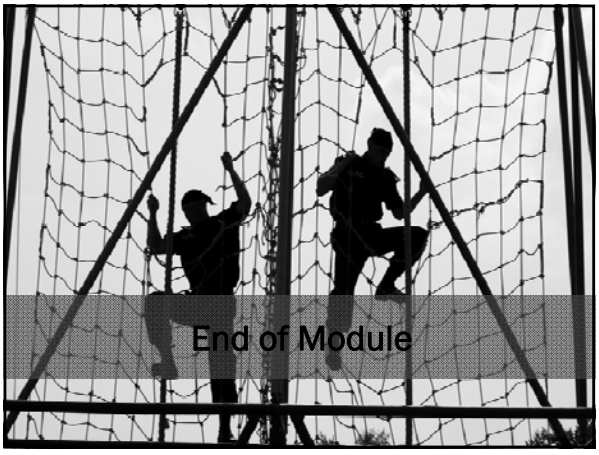
	Accumulation	Transmutation	Realization
Time frame	2-6 weeks	2-4 weeks	1-2 weeks
Movements	General patterns	Task specific	Task specific
Focus	Aerobic endurance Muscular strength	Aerobic-anaerobic endurance Strength-endurance	Taper and recover

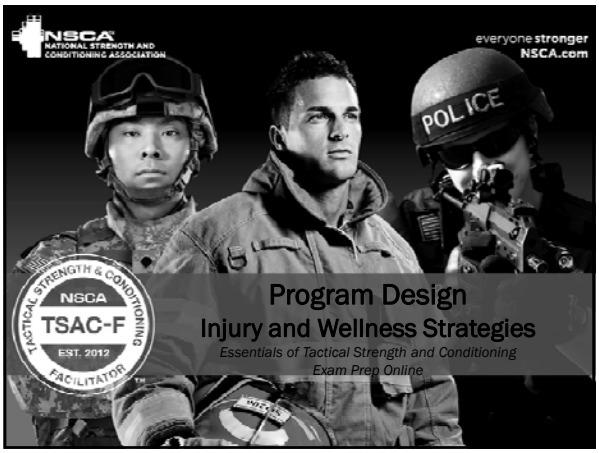
Summary of Periodization Strategies

Periodization Type	Intensity Trend	Volume Trend	Specificity Trend	Recommended Training Status
Linear	Low to high	High to low	General to specific	Beginner and intermediate
Non-linear	Variable	Variable	Variable	Advanced
Block	Low to high	High to low	General to specific	Beginner, intermediate, advanced

Periodization Review

- Primary objective of periodization
  - Maximize training results
- Secondary objective (equally important)
  - Prevent overtraining
- Training continuum
  - ➢ Overload stimulus (workout)
    - ➢ Acute fatigue (post-workout)
      - ➢ Overreaching (short-term excessive training w/tapering)
        - ➢ Overtraining (if adequate rest not incorporated)





Copyright

Content Weighting

Program Design Topic Areas	RE	AP	AN	Total
Program Design for Injury and Wellness	1	3	0	**4**

Topics

- The phases of tissue repair and appropriate training objectives for each phase
- Exercise modifications for common injuries
- Wellness strategies that may reduce the risk of heart disease

Types of Injury

- Macrotrauma
  - A specific, sudden episode of overload resulting in a disruption of tissue integrity
- Microtrauma
  - Overuse injury resulting from repeated, abnormal stress

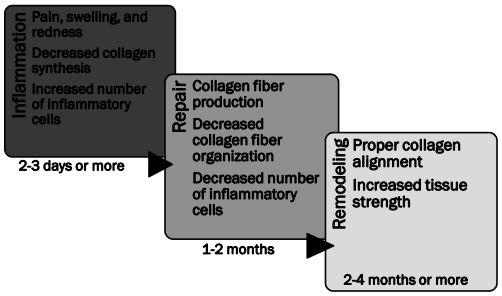
Macrotrauma Injuries

- Injury to bones
  - Fracture: Partial or complete break in a bone
  - Dislocation/subluxation: Complete or partial displacement of joint surfaces
- Injury to muscle/tendon
  - Strain: Partial or complete tear of muscle fibers
  - Contusion: Direct trauma resulting in blood/fluid accumulation around the damaged area
- Injury to ligaments
  - Sprain: Partial or complete tear of a ligament

Microtrauma

- Possible causes
  - Training errors - overtraining/poor program design
  - Suboptimal training surfaces
  - Faulty biomechanics or movement technique
  - Poor flexibility
- Injury to tendon
  - Tendinitis: Inflammation of the tendon
- Injury to bone
  - Stress fracture

Phases of Tissue Healing



Rehabilitation

- Maintain function of cardiorespiratory and surrounding neuromuscular systems
- All activities should be performed at the direction of a rehabilitative professional
- Guidelines based on
  - Indications
  - Contraindications
  - Precautions

Rehabilitation

Goals	Inflammation	Repair	Remodeling
Control pain and inflammation (RICE)	X		
ROM, flexibility		X	Maintain
Balance, proprioception, neuromuscular control		X	X
General strengthening		X	X
Functional strengthening			X
Return to activity			X

Common Injuries

Common Injury	Identified Causes
Military Overtraining injuries Back strain	 Focus on cardiovascular endurance Lack of strength training Lack of functional training
Firefighters Shoulder injuries Upper back strain	 Repetitive activities Lifting and carrying of loads Unilateral loads
Police Back strain Hamstrings Rotator cuff	 Focus on strengthening of anterior muscles

Low Back Pain

Injury	Movement Contraindications	Exercise Contraindication	Exercise Indications
Disc injury	Lumbar flexion Lumbar rotation	Sit-up Knee-to-chest stretch Spinal twist	Passive lumbar extension stretches Isometric abdominal and extensor strengthening Progress to lumbar stabilization
Muscle strain	Passive lumbar flexion Active lumbar extension	Knee-to-chest stretch	None during inflammation phase Progress to gentle flexion stretching and extension strengthening


Shoulder Injuries

Injury	Movement Contraindications	Exercise Contraindication	Exercise Indications
Impingement syndrome	Overhead with internal rotation Painful motions	Shoulder press Lateral dumbbell raise Incline bench press	Rotator cuff strengthening exercises Pain-free exercises
Rotator cuff pathology	Resisted overhead motions	Painful exercises Early quick eccentric actions	Rotator cuff strengthening exercises

Exercises should be monitored to ensure engagement of scapular and rotator cuff muscles to stabilize the joint


Ankle and Knee Injuries

Injury	Movement Contraindications	Exercise Contraindication	Exercise Indications
Inversion ankle sprain	Inversion with weight bearing	Activities requiring loaded or full weight bearing	Open chain ROM and strength activities until weight bearing permitted
Anterior knee pain	Closed chain knee movements > 90° flexion Open chain knee movements <30° extension	Full squat Full lunge End range of leg ext	¼ to ½ squat or leg press Partial lunge Leg curl


Key Points of Rehabilitation

- Communication with rehabilitative professionals
- Maintenance of cardiorespiratory conditioning
- Modify activities
- Pain-free activities
- Progressive return to activity

Topics

- Factors that influence wellness
- Wellness recommendations

Wellness

"The state or condition of being in good physical and mental health."

- Factors that influence the wellness of tactical athletes include:
  - Nutrition
  - Physical activity
  - Stress
  - Smoking
  - Sleep


Wellness

- Coronary artery disease
  - Positive risk factors
    - Obesity
    - Dyslipidemia
    - Prediabetes
    - Sedentary lifestyle
    - Hypertension
    - Cigarette smoking
    - Advanced age
    - Family history of heart disease


Stress Management

- Recognize
  - Emotional changes
    - Negativity
    - Sadness
    - Loss of motivation
  - Mental changes
    - Poor concentration or memory
  - Behavioral changes
    - Changes in normal patterns
  - Physiological changes
    - Decreased performance


Stress Management

- Assess
  - Emotional stress inventories
  - Standard exercise testing
    - Decreased performance
- Develop intervention strategies
  - Referral to qualified professional


Smoking

- Why smoke
  - Stress relief
  - Peer pressure
- Military smoking rates higher than public
- Impairs any tactical athlete's readiness
  - Reduces the transport of oxygen
    - Cardiovascular system works harder
  - Lowers HDL
    - Increasing risk of atherosclerosis


Smoking Cessation

- Address readiness to quit and set a date
- Program referral
  - Include stress management
- Understand and educate
  - Nicotine addiction
  - Triggers
  - Withdrawal and stress management coping mechanisms
  - Relapse prevention and weight gain


Sleep Deprivation

- Physiological effects
  - Decreased glucose metabolism/glycogen synthesis
  - Increased cortisol secretion
  - Decreased growth hormone secretion
- Physical health effects
  - Reduced hand-eye coordination
  - Weight gain
  - Pain (e.g., backaches, headaches)
  - Inability to relax


Sleep Deprivation

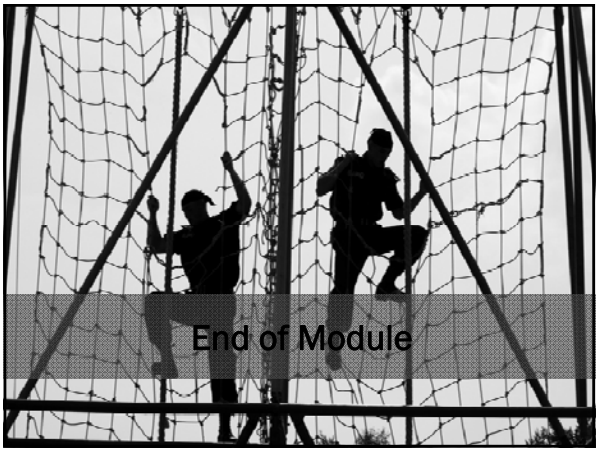
- Mental health effects
  - Increased mood swings
  - Impaired judgment
  - Decreased ability to adapt to situations
  - Heightened sense of threat
  - Increased anxiety or depression
  - Increased chances of mental illness (e.g., post-traumatic stress disorder or bipolar disorder)

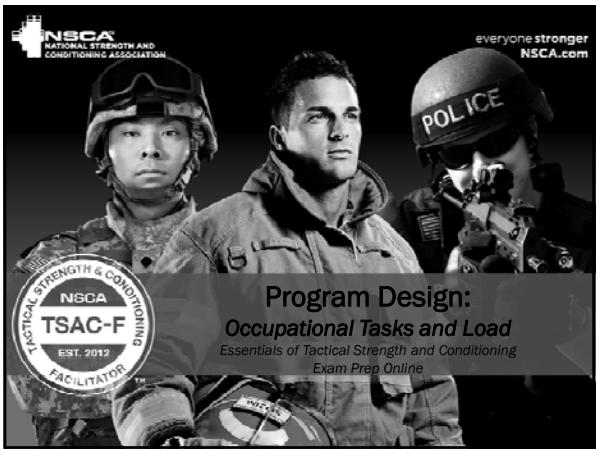

Sleep Deprivation

- Work-related issues
  - Increased illness
  - Decreased performance
  - Inappropriate use of force more frequently
  - Involved in more vehicular accidents
  - Experience more accidental injuries
  - Increased difficulty dealing with others
  - Increased likelihood of dying in the line of duty


Sleep/Rest Recommendations

- Seek adequate daily sleep when possible, but do not oversleep; at least 4-5 hours
- Reduce additional stress when possible
- Exercise regularly
- Become an effective sleeper
  - Relax prior to sleeping
  - Avoid nicotine, caffeine, and alcohol prior to sleeping
  - Calm, dark environment; avoid TV and lights
- Nap only if necessary





Copyright

Content Weighting

Program Design Exam Content	RE	AP	AN	Total
Population-Specific Considerations	2	12	12	**26**

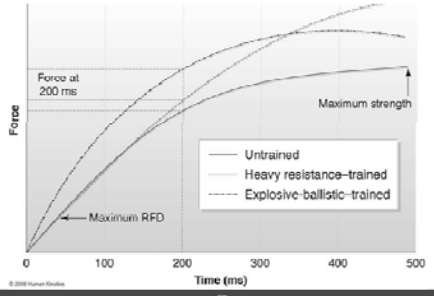
Topics

- The components of a training program and their interdependency
- Identification of methods that specifically apply to occupation-related tasks

Strength-Power Relationship

- Strength (and max strength)
  - Generating maximum force over a distance
- Muscular endurance
  - Generating low amounts of force repeatedly
- Power
  - Generating high amounts of force quickly
- Power-endurance
  - Generating high amounts of force quickly and repeatedly

Rate of Force Development (RFD)



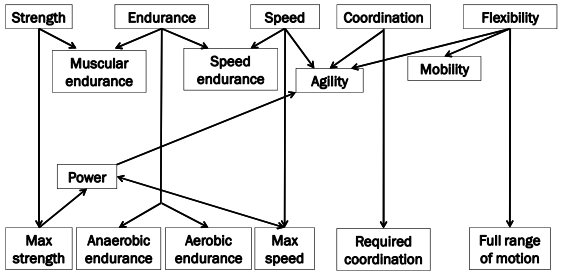
RFD and Tactical Athletes

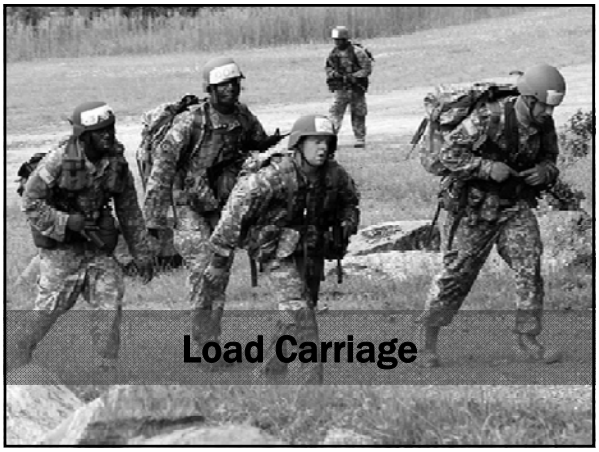
- Rate of force development
  - Power training (Olympic lifting, plyometrics, medicine balls, etc.)
    - Increases the speed at which force can be exerted
  - Strength training (squats, deadlifts, bench press, etc.)
    - Increases the maximal amount of overall force production, increases fat-free mass, and can supplement power development

Aerobic-Anaerobic Training

- Compatibility
  - Resistance training + aerobic endurance training
    - May interfere with strength and power gains
    - Greater aerobic development
  - Sprint training + aerobic endurance training
    - Decreased sprint speed and jump power
- Concurrent training vs. independent training days

Training Factor Relationships





Topics

- Effect of carrying equipment on the biomechanical demands and movement patterns
- Appropriate exercise selection to meet these demands
- Methods to manipulate issues specific to tactical athletes

Load Carriage

- Load carriage
  - Examples: Body armor, firearms, communication devices, SCBA, hoses, rucksacks
- Performance effects
  - Decrease speed, power, and agility
  - Decrease marksmanship
  - Increase injury risk

Impact of Load Carriage

- Studies show that load carriage can result in
  - ↑ VO_2
  - ↑ Ventilation
  - ↑ Heart rate
  - ↑ Respiration rate
  - ↑ Ratings of perceived exertion (RPE)
  - ↓ Lower and upper body endurance

Injuries

- Advances in technology have increased the load carried by tactical athletes
  - Common load amounts: 60-130 lb
- Heavier loads result in ↑ injuries, primarily in the low back
- Load carriage is common cause of:
  - Falls/loss of balance among firefighters
  - Strains and sprains among police, EMS, and firefighters

Improving Load Carriage Capacity

- Factors affecting load carriage capacity (LCC)
  - Fat-free mass
  - Aerobic fitness
  - Leg/back strength
- Conduct assessments to determine:
  - Fat-free mass
  - Isometric lower back extension strength
  - Isometric upright pull strength
  - Dynamic lift strength
  - Incremental shuttle run

Improving Load Carriage Capacity

- Program prescription based upon:
  - Pre-training performance tests
  - Mission-specific needs
- Training to improve LCC should include:
  - Strength/hypertrophy
  - Power/anaerobic
  - Aerobic
  - Task demands

Sample Training Exercises: LCC

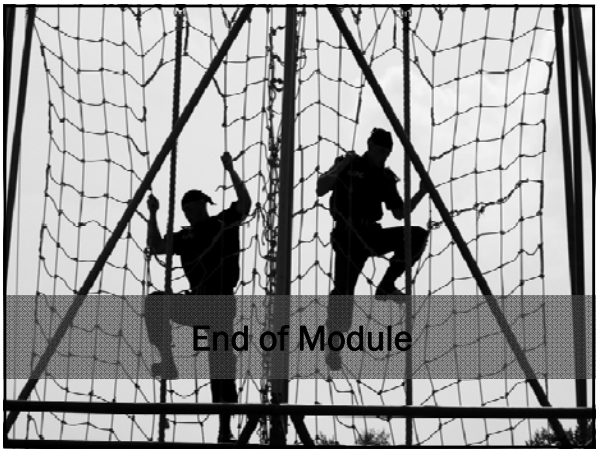
Workout	Sample Exercises (sets x reps)				
Upper body push	Bench press 3 x 6-8	Incline bench 3 x 6-8	Military press 3 x 6-8	Upright rows 3 x 8-10	Triceps dips 3 x 6-8
Upper body pull	Lat pulldown 3 x 6-8	T-bar row 3 x 6-8	Shrugs 3 x 6-8	Barbell curls 3 x 8-10	Hammer curls 2 x 8-10
Lower body	Squats 3 x 6-8	Leg press 3 x 6-8	Barbell lunge 2 x 8-10	Prone leg curl 3 x 8-10	Calf raise 3 x 8-10
Trunk stabilizers	Low back ext 4 x 8-10	Incline sit-ups 3 x 20-50	Leg raises 3 x 15-20	Ab crunches 3 x 30-50	
Plyometrics and anaerobic conditioning	Depth jumps 4 x 5	Box jumps 4 x 5	Single-leg hops 4 x 5	Lateral barrier hops 4 x 5	Interval sprints 10-15 (1 min rest)
Aerobic/core	30 min jog	Abs and low back	Ruck march	Start depends on fitness level, progress load or distance (not both)	

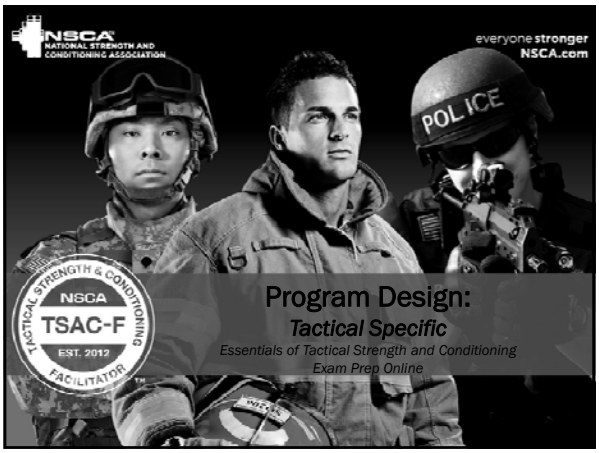
Sample Monthly Program: LCC

	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Week 1	Upper push	Power and anaerobic	Upper pull	Aerobic	Lower and core	Rest	Aerobic
Week 2	Ruck march	Rest	Upper push/pull	Aerobic	Lower and core	Rest	Power, anaerobic, aerobic
Week 3	Upper push	Power and anaerobic	Upper pull	Aerobic	Lower and core	Rest	Aerobic
Week 4	Ruck march	Rest	Upper push/pull	Aerobic	Lower and core	Rest	Power, anaerobic, aerobic

LCC Conclusion

- Tactical athletes will continue to conduct real-life dangerous operations under load-bearing conditions
- Programming concurrent training with at least bimonthly load-bearing training may improve:
  - Ability to perform load-bearing tasks
  - Lower energy demands
  - Reduce frequency of musculoskeletal injuries
  - Improve maneuverability with external loads





Copyright

Content Weighting

Program Design Exam Content	RE	AP	AN	Total
Population-Specific Considerations	2	12	12	**26**

Topics

- Identification of critical job tasks
- Common injury prevalence and risk factors for firefighters
- Occupation-related exercises
- Design of a periodized program based on the job task analysis

Task Analysis

- CPAT (candidate physical ability test)
  - Wearing a 50-lb vest, hard hat, and gloves
  - Total time allowed: 10 min and 20 s
    1. Stair climb - weighted (25 lb) for 3 min
    2. Hose advance drag and pull - 150 ft
    3. Equipment carry - 75 ft
    4. Ladder raise and extension
    5. Forcible entry – using a sledgehammer
    6. Search – crawl position through a maze
    7. Rescue – drag 165-lb mannequin 70 ft
    8. Ceiling breach and pull –push 60 lb x 3 and pull 80 lb x 5

Injury Analysis

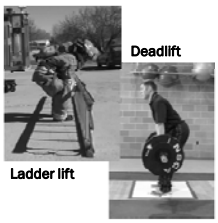
- Cardiovascular events
- Ergonomic-related disorders (ERDs)
  - Repetitive nature of activities
  - Level of force exertion
  - Awkward body positions
- Individual-specific issues

Training Goals

Tasks:	1	2	3	4	5	6	7	8	Injuries
Aerobic endurance		X	X	X	X	X	X	X	X
Anaerobic endurance	X	X	X	X	X	X	X	X	
Agility	X	X		X	X	X	X	X	X
Muscular endurance	X	X	X	X	X	X	X	X	X
Muscular strength	X	X	X	X			X		X
Muscular power	X		X		X			X	
Flexibility				X		X	X	X	X

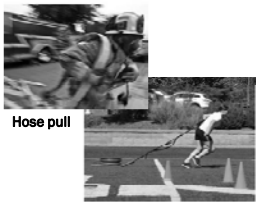
Exercise Selection

- Movement specificity



Deadlift

Ladder lift



Hose pull

Weighted pull

Undulating Periodization

- No specific competition period within a year
  - Tactical athletes work in a state of "emergency readiness"
- Superior improvements in populations working in constant emergency readiness
  - "Undulation Training for Development of Hierarchical Fitness and Improved Firefighter Job Performance"

* Peterson, M, Dodd, D, et al. Undulation Training for Development of Hierarchical Fitness and Improved Firefighter Job Performance. *Journal of Strength & Conditioning Research* 22(5):1683-1695, 2008.

Sample Weekly Program

	Day I	Day II	Day III
Upper body	Endurance/hypertrophy	Strength	Power/speed
Lower body	Strength	Power/speed	Endurance/hypertrophy

* Peterson, M, Dodd, D, et al. Undulation Training for Development of Hierarchical Fitness and Improved Firefighter Job Performance. *Journal of Strength & Conditioning Research* 22(5):1683-1695, 2008.

Sample Training Program

Weeks 1-3	Hypertrophy/ endurance	Strength	Speed/power
Volume (# sets/muscle group)	5-7	3-5	2-4
Intensity	65-75%	75-85%	Bodyweight - 30% 1RM
Movement Tempo	Slow	Moderate	Fast
Rest Break (sec)	< 90	120-240	120-300
Mode (exercise choice)	Combination	Free weights	Bodyweight plyometrics
Weeks 7-9			
Volume (# sets/muscle group)	7-9	5-7	4-6
Intensity	75-85%	90-100%	Bodyweight - 75% 1RM
Movement tempo	Slow	Attempt fast	Fast + explosive
Rest break (sec)	< 90	120-240	120-300
Mode (exercise choices)	Combination	Free weights	Free weights, resisted plyometrics, sprints

* Peterson, M, Dodd, D, et al. Undulation Training for Development of Hierarchical Fitness and Improved Firefighter Job Performance. *Journal of Strength & Conditioning Research* 22(5):1683-1695, 2008.

Topics

- Identification of critical job tasks
- Common injury prevalence and risk factors for law enforcement officers
- Occupation-related exercises
- Design of a periodized program based on the job task analysis

Task Analysis

Task	Physiological goals
Stair climbing	Increase fat-free mass Aerobic and anaerobic conditioning Lower body muscular endurance
Restraint holds	Increase isometric strength and muscular endurance in the upper body
Chasing suspects	Max speed and speed-endurance Agility
Climbing/jumping	Plyometrics, lower body power Upper body relative strength

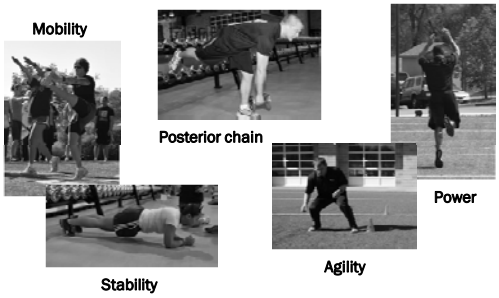
Injury Analysis

- Injury concerns
  - Sprains/strains and musculoskeletal disorders (primarily the low back)
  - Hamstrings and rotator cuff
- Probable causes
  - Mobility and flexibility
  - Immediate response
  - Overemphasis on anterior training

Training Goals

Tasks:	Stair climbing	Restraint holds	Chasing suspects	Climbing /jumping	Injuries
Aerobic endurance	X		X	X	
Anaerobic endurance	X	X	X	X	
Agility			X	X	X
Muscular endurance	X	X	X	X	X
Muscular strength		X		X	X
Muscular power			X	X	
Flexibility		X		X	X

Exercise Selection



Exercises for Critical Job Tasks

Door Breach

MB scoop toss

MB slam

MB chop

Undulating Periodization

- No specific competition period within a year

Tactical athletes work in a state of "emergency readiness"

Sample Program Design

	Day I	Day II	Day III
Upper body	Endurance/hypertrophy	Strength	Power/speed
Lower body	Strength	Power/speed	Endurance/hypertrophy

Weeks 1-3	Hypertrophy/ endurance	Strength	Speed/power
Volume (# sets/muscle group)	5-7	3-5	2-4
Intensity	65-75%	75-85%	Bodyweight - 30% 1RM
Movement tempo	Slow	Moderate	Fast
Rest break (sec)	< 90	120-240	120-300
Mode (exercise choice)	Combination	Free weights	Bodyweight/medicine ball plyometrics

Sample Program: Agility

	Sets	Reps	Volume	Yardage
Level 1	2-4	2-4	4-16	160-640
Level 2	3-5	3-5	9-25	360-1,000
Level 3 and 4	4-6	4-6	16-36	640-1,440

Level 1
- Shuffle into a run
- Carioca into a run
- Backpedal into a run
- Butt kick into a run
- Crossover run into a run
- Backward skip into a run
- Slide kick into a run
- Lateral skip into a run
- Backward butt kick into a run
- Cycle kick into a run
- Shuffle skip into a run

Level 2
- Circle drills
- "T" drill
- "L" drill

Level 3
- "W" or "M" drills
- "V" or triangle drills
- Square drills

Level 4
- 5-1-5 short shuttle
- Suicide/jingle-jangles
- Sprint/backpedal drills

Topics

- Identification of critical job tasks
- Common injury prevalence and risk factors for conventional military and special operations
- Occupation-related exercises
- Design of a periodized program based on the job task analysis

Task Analysis

Event	Components				
	Strength	Endurance	Mobility	Speed	Power
400-meter run (w/wpn)		x	x	x	x
IMT (low hurdles, high crawl, under/over)		x	x	x	
Casualty drag (sled)	x	x	x	x	x
Balance beam ammo can carry (30 lb ea)	x	x	x	x	
Point-aim-move		x	x	x	
100-yard ammo can shuttle sprint (30 lb ea)	x	x	x	x	x
Agility sprint			x	x	x

Injury Analysis

- Military engagement
  - Non-combat musculoskeletal injuries: 34%
- Basic combat training (BCT)
  - Most common injuries are musculoskeletal
    - 25% lead to early medical discharges

Injury Analysis

- Strong evidence for injury in BCT related to:
  - Gender
  - Low aerobic fitness
  - High and low extremes of flexibility
  - Low levels of activity prior to training
  - Cigarette smoking

Training Goals

Urban operations skill	Physical requirements	Muscular strength	Muscular endurance	Aerobic endurance	Anaerobic endurance	Mobility
Crossing open areas	Sprint, crouch	X	XX	X	XX	XX
Movement parallel to buildings	Sprint, crouch	X	XX	X	XX	XXX
Movement past windows	Sprint, crouch, step or jump	X	XX	X	XX	XXX
Movement around corners	Enter/exit prone position	X	XX	X	XX	XX
Crossing a wall	Climb wall, roll, land	XX	X	X	XX	XX
Use of doorways	Sprint, crouch	X	XX	X	XX	XXX
Movement between positions	Sprint, enter/exit prone, kneel	X	XX	X	XXX	XXX
Injury analysis				X		X

Exercise Selection

Back squat

Weighted drag

Agility course

Basic Program Design

Undulating or Linear Periodization

- Preparation for deployment
- Deployment

Tactical athletes work in a state of "emergency readiness"

Sample Weekly Workout

Weeks 1-3	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Resistance training	3 x 12		3 x 12		3 x 12	
Interval runs	Interval 1		Interval 1		Interval 1	
Circuit training		30s/30s 3 sets 5 min rest		30s/30s 3 sets 5 min rest		30s/30s 3 sets 5 min rest
Force march		5 mi. 40-lb rucksack road		5 mi. 40-lb rucksack uneven terrain		5 mi. run
Weeks 7-9	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**
Resistance training	3 x 6		3 x 6		3 x 6	
Interval runs	Interval 1		Interval 2		5 mi. run	
Circuit training		30s/30s 3 sets 5 min rest		30s/30s 3 sets 5 min rest		30s/30s 3 sets 5 min rest
Force march		5 mi. 50-lb rucksack road		5 mi. 50-lb rucksack uneven terrain		5 mi. 50-lb rucksack uneven terrain

Sample Intervals

Interval 1

- 10 x 40 yards
  3 min recovery
- 8 x 40 yards
  2 min recovery
- 6 x 40 yards
  90 s recovery
- 4 x 40 yards
  60 s recovery
- 2 x 40 yards
  30 s recovery
- 1 x 40 yards

Interval 2

- 3 x 40 yard ladder
  2 min recovery

  5 min recovery
- 3 x 300 yard shuttle
  2:30 min. recovery