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DEVELOPMENTAL MODEL FOR PROSPECTIVE MALE AND FEMALE US AIR FORCE SPECIAL WARFARE CANDIDATES—PART II: TRAINING PROGRAM MANAGEMENT

The views expressed are those of the authors and do not necessarily reflect the policy or the position of the Department of the Air Force, the Department of Defense, or the United States Government.

INTRODUCTION

In the initial installment of this article series, the authors provided a brief exploration of previous literature relevant to the preparatory training of both men and women hopeful to enter the United States Air Force Special Warfare (AFSPECWAR) pipeline, which included comparisons of historical aerobic and strength/power sport performances, training outcomes during other military programs of initial entry, and physiological basis for the recommendations contained within this article (13). Part II will focus on management of that training process, incldiung providing suggested training volumes, frequencies, and intensities intended to meet the demands to be encountered within the first phases of a Special Warfare Operator's development as well as a method to identify the length of introductory program duration based on absolute and relative performance in relation to entry requirements and known sources of injury risk.

Pre-enlistment physical training for those hopeful to be accepted into the formal AFSPECWAR training program should include a substantial amount of physical preparation directed toward the mastery of load carriage in the form of high frequency ground impacts including extensive and intensive plyometrics as well as traditional loaded marches. The manipulation of heavy objects as a skill should be included supplementary to training intended to increase the probability of passing the Physical Skills and Stamina Test Physical Abilities Stamina Test (PAST) (now referred to as Initial Fitness Test [IFT]), which includes "traditional" preparatory methods such as high-volume running, bodyweight calisthenics, resistance training, and swimming. In keeping with many of the "Ten Pillars for Successful Long-Term Athletic Development" highlighted in the National Strength and Conditioning Association (NSCA) position statement, developmental programs should aim to reduce or mitigate the risk of injury to ensure ongoing participation and continued physical development, as well as provide multiple modes of exercise to training to enhance health and specific skill-related fitness with systematic progression principles (11).

PART I: REVIEW

It should be acknowledged that the stress incurred during preparatory training geared toward passing the IFT, previously referred to as the PAST, the objective measure of preparedness for entry into basic military training (BMT) and the Special Warfare Candidate Course (SWCC), may increase the chance of injury in relation to most recreational physical training programs. An example of a common occupational task, or end-state goal that would also present injury risk in AFSPECWAR Operators and highlighted in Part I of this series, was the ability to move more than 15 mi while wearing 45 lb of personal protective equipment (PPE) and a 60-lb rucksack (12). Another common task within the occupational training pipeline that has been observed to be associated with upper-extremity injury in this population is the manipulation and utilization of ropes in the form of mountaineering, rescue operations, fast roping, and the ascent or descent of rope ladders. These "end-state performance goals" would be realized near completion of the approximately two-years of specialized training; however it has been documented that competency in general physical tasks can be highly influenced by the length of specific training history (5). In the first installment of this series, it was further noted that the greatest proportion of musculoskeletal injuries (MSKI) reported in this specific population were diagnosed as general or non-specific and affecting the lower extremities, with many injuries happening 30 – 180 days after entering apprentice training (3).

PROGRAM GOALS

The principle aim of this article is to provide each person, male or female, with awareness of the entry criteria, the necessity to surpass those criteria, the physiological adaptations necessary to arrive and immediately integrate into the established training program within the AFSPECWAR pipeline, and to provide an opportunity to familiarize themselves with the foundational work that may be necessary for completion of other highly competitive military selection processes. During each phase of this training program, the demands will build upon the last phase to provide greater individual resistance to high volume metabolic and cardiovascular challenge, ground impact demand, external load manipulation, and an overall physical robustness necessary to endure each stage of initial training. Once complete, those who fulfill the demands of this program should be able to clearly exceed IFT standards of performance, have increased physical work tolerance relevant to grueling load carriage over distance,

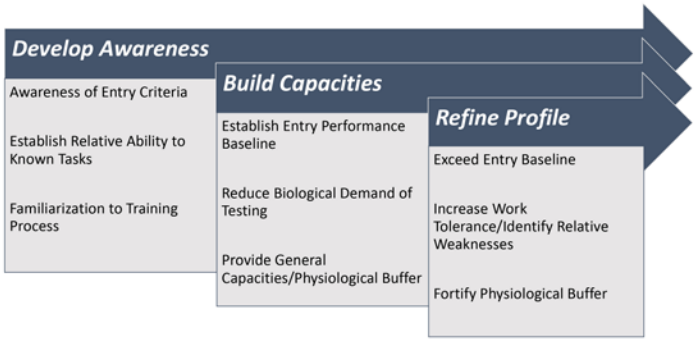

FIGURE 1. PROGRAM GOALS

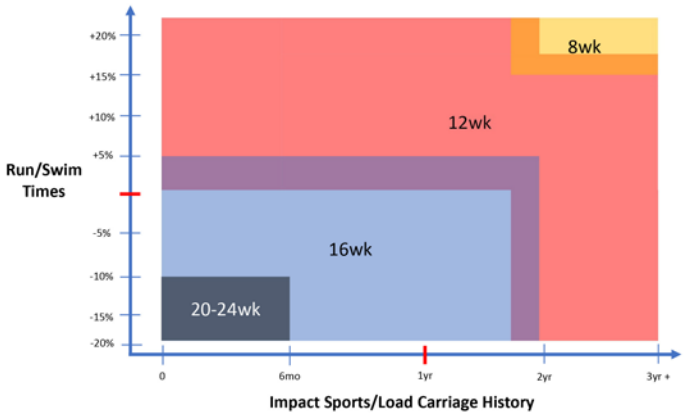

FIGURE 2. PROGRAM LENGTH DECISION MATRIX

and fortified their physiological buffering capacities to complete these tasks for successive days or weeks. Figure 1 provides visual representation of these overarching intentions.

An emphasis on frequency of important physical qualities will be the foundation of this intervention to supplement the sex-differences in translation of key metabolic factors observed between men and women in response to similar training programs. Additionally, the structure and duration of the program will initially hinge on general physical ability in relation to the known entry criteria and transition toward a more specific and absolute non-negotiable performance standard that indicates readiness to begin more formal AFSPECWAR training programs. See Figure 2 for a visual representation of the process for determination of the suggested length of the preparatory period as determined by relative aerobic performance and specific training, or exposure, history. This graphic is theoretical but may provide clarity when establishing timelines and identifying key training interventions. Run and swim performance were selected as primary screening tools due to the vast amount of evidence that aerobic performance clearly contributes to injury risk within entry-level military, sport, and general fitness populations (3,7,14).

Load carriage and impact sport history has also been established to be associated with bone mineral density (BMD), as individuals who exhibit low BMD have previously been identified to have an increased risk of injury during sports or military training (13,19,20). Overall training phase and program lengths are suggested due to the observed rates of skeletal muscle, connective tissue, and bone adaptation reported in similar groups of active young-adults of both biological sexes (2,8,9). Lastly, prior MSKI has a historically established influence to future injury in AFSPECWAR cohorts (3). The authors would suggest an extended preparatory period of at least 16-weeks and encompassing, at least phases 1 – 3, as a protective measure when a potential candidate has had prior MSKI that has resulted in periods where physical training or competition was halted or limited due to that injury within the prior 12-months (15). This suggestion is extended regardless of entrance test performance or training history duration.

The ability to surpass each expectation of the IFT should be desired prior to attendance to the AFSPECWAR training pipeline, but this test is not entirely representative of the rigors to be faced later within this training environment. It may be helpful to view the IFT, or similar military entry testing, as an assessment that could indicate whether a person is prepared to commence training within the pipeline, but not necessarily to complete the pipeline. Those who test higher during initial fitness evaluations may then be better prepared to begin the specific developmental process, which can impart much greater physical demand in the form of external load carriage, time demands, and a greater array of mental and physical difficulties over vast periods of time and distances when compared to the IFT (2,6,11,23).

RELATIVE ASSESSMENT OF ABSOLUTE PERFORMANCE CRITERIA

Establishing the initial parameters for training interventions directed toward attendance of a military training and selection program can often lead to an outcome-biased approach, as "success" hinges on performance of absolute tasks. Enlisting candidates must successfully complete all portions of the IFT to minimum standards prior to arrival at BMT and once more prior to acceptance into SWCC at the completion of BMT. There should be primary emphasis that these standards are minimums, and it is in the opinion of the authors that each potential candidate would be well served to surpass these expectations by as much as possible before arrival. Minimum IFT performance criteria and the suggested order of events when completing pre-testing is indicated in Table 1.

It would be valuable to ensure each potential candidate is aware of these criteria as non-negotiable for entry into the desired AFSPECWAR career fields, as stated above. Ensuring this relationship is explicitly represented prior to arrival will lessen

TABLE 1. SWCC ENTRY STANDARD ASSESSMENT GUIDE

	Event	-20%	-15%	-10%	-5%	Minimum Standard	5%	10%	15%	20%
1	1.5mi Run (mm:ss)	12:24	11:53	11:22	10:51	10:20	9:50	9:29	8:58	8:37
2	Pull Up in 2:00 (mm:ss)	5	6	7	7	8	9	9	10	12
3	Push Up in 2:00 (mm:ss)	32	34	36	38	40	42	44	46	48
4	Sit Up in 2:00 (mm:ss)	38	41	44	47	50	53	55	58	60
5	500m Surface Swim (mm:ss)	18:00	17:15	16:30	15:45	15:00	14:15	13:30	12:45	12:00

much of the anxiety and difficulty in an already stressful situation and confidently mitigate the chances of non-acceptance into training. An excellent method to integrate the elements vital to being prepared for a challenging physical training or selection course would be to emphasize training that is most relevant to the exact qualities that are tested during that course while constantly exposing each potential candidate to the training intended to provide robustness against known sources of injury (e.g., lower-extremity injuries in the presence of extended load carriage and running training).

SPECIFIC TRAINING HISTORY

Achievement of physical abilities can be thought of as the sum of training frequency, duration of specific training sessions, length of that training program, and the intensity of that training in relation to the demand of the task (6). In lieu of an extended training period, 5-years of load carriage training which has been shown to be beneficial in performance of that task independent of body weight or biological sex for example, it is necessary to exploit the factors of frequency, intensity, and duration explicitly directed toward those goals most pertinent to the AFSPECWAR candidate (5). Identification of those factors at the initiation of training requires specific testing. Once proficiency and ability have been identified and compared to known entry or completion standards, the length of the program can be estimated within the personal context of available training time the individual has available.

For example, an individual who did not participate in contact sports or load carriage who is attending school and working a moderate to highly physical job 4 – 5 days per week may not be able to train more than three days per week. This situation may indicate that their specific training program may need to be longer in comparison to someone who is not attending school or working multiple days per week with a better training history. In contrast, a potential candidate who performs well above the established standards and has a history of load carriage experience may require a shorter training program or possibly make due training with less frequency in order to simply meet or exceed initial-entry performance standards, due to the fact they have already displayed the physical aptitude and have possibly incurred the adaptations that would facilitate the training to increase tolerance of the biological tissue to the known physical tasks within the program. Though, it is advised to take heed of the general training recommendations in this article as best as possible. Limiting frequency (less than three training days per week) may not detrimentally affect IFT performance but may also not aid in mitigation of overuse-type injuries common to AFSPECWAR, as physical training occurs multiple times a day over the five-day training week.

PRE-TESTING

Initial testing can be conducted in one day in the following order with at least five minutes of rest between test events (Table 1) or over multiple days, again with five minutes of rest between events on each day. Only conduct water-event testing and training when a qualified lifeguard or swim instructor is present. For best results, seek to maintain the prescribed order of events; completing all events within a week, regardless of order, is also acceptable if that is the only option. Once testing is complete, compare individual results to the entry standards to establish length of the program, initial workload parameters, and program structure. It is not necessary to conduct testing each week, but a frequency of once every 4 – 6 weeks can provide a snapshot of progress as well as provide a time to rehearse the IFT.

TRAINING PROGRAM DAILY STRUCTURE

Each day, training will be prioritized by the importance of each task. This means the most important activities for that day and phase of training will be placed first with respect to the magnitude of residual fatigue and necessary volume of exposure necessary

TABLE 2. DEVELOPMENTAL PROGRAM MANAGEMENT

Pre-SWCC Program Element Suggestions				
Phase	0: Training Familiarization	1: Establish Work Capacities	2: Increase Workload Tolerance	3: Exceed Entry Baseline
Duration	4-6 Weeks	4-6 Weeks	4-6 Weeks	4-6 Weeks
Plyometrics	**Frequency:** 2-3 days/week **Weekly Volume:** 100-150 reps **Structure:** 40-50 reps/session Double to Single Leg Low Amplitude **Suface:** Grass/Rubber Track **Load/RPE:** 3-5 RPE, band assist **Intent:** Quality Movement **Rest:** 180s	**Frequency:** 2-3 days/week **Weekly Volume:** 200-250 reps **Structure:** 50-75 reps/session Single Leg (75%) Low/Mod Amplitude **Suface:** Grass/Rubber Track **Load/RPE:** 4-6 RPE, bodyweight **Intent:** Quality Movement **Rest:** 120s	**Frequency:** 3-4 days/week **Weekly Volume:** 300-500 reps **Structure:** 100 reps/session Double to Single Leg Mod Amplitude **Suface:** Rubber Track/Hard **Load/RPE:** 4-6 RPE, +10-20lbs **Intent:** Rhythm/Balance **Rest:** 60s	**Frequency:** 4 days/week **Weekly Volume:** 400-600 reps **Structure:** 125-175 reps/session Single Leg (75%) Mod/High Amplitude **Suface:** Rubber Track/Hard **Load/RPE:** 4-6 RPE, +15-30lbs **Intent:** Rhythm/Transitions **Rest:** 30-60s
Run	**Frequency:** 1 day/week **Weekly Volume:** 3500-7000m **Structure:** 1:3 Work/Rest **Long Day:** 100m-300m **Long Pace:** 2.68 m/s (10:00/mile) **Short Day:** 10-100m Runs **Short Pace:** Variable (5-8 RPE)	**Frequency:** 1-2 days/week **Weekly Volume:** 4300-8000m **Structure:** High/Low **Long Day:** 12-24min LSD **Long Pace:** 2.68 m/s (10:00/mile) **Short Day:** 30-150m Runs **Short Pace:** Variable (5-8 RPE)	**Frequency:** 2-3 days/week **Weekly Volume:** 5400-9000m **Structure:** High/Low **Long Day:** 18-28min LSD **Long Pace:** 2.68 m/s (10:00/mile) **Short Day:** 200m Runs **Short Pace:** 4.76-5.56m/s (36-42s)	**Frequency:** 3 days/week **Weekly Volume:** 6700-10000m **Structure:** High/Low **Long Day:** 20-30min LSD **Long Pace:** 2.68 m/s (10:00/mile) **Short Day:** 400m Runs **Short Pace:** 4.44 m/s (90s)
Resistance Training	**Frequency:** 2-3 days/week **Weekly Volume:** 280-240 reps **Structure:** 2-10 rounds/circuit 3-4 exercises/circuit 1-20 reps/exercise **Load/RPE:** 10lb vest/RPE 3-6 **Intent:** Quality movement **Rest:** As Needed	**Frequency:** 2-3 days/week **Weekly Volume:** 500-600 reps **Structure:** 3-8 rounds/circuit 3-9 exercises/circuit 3-20 reps/exercise **Load/RPE:** 10lb vest/RPE 6-8 **Intent:** Quality movement **Rest:** 60-90s per round	**Frequency:** 2-3 days/week **Weekly Volume:** 500-800 reps **Structure:** 2-3 rounds/circuit 5-12 exercises/circuit 4-15 reps/exercise **Load/RPE:** 15-20lb vest/RPE 5-7 **Intent:** Finish all reps in time **Rest:** 60s per round	**Frequency:** 3-4 days/week **Weekly Volume:** 600-825 reps **Structure:** 2-4 rounds/circuit 4-6 exercises/circuit 3-20 reps/exercise **Load/RPE:** 20-25lb vest/RPE 6-8 **Intent:** Finish all reps in time **Rest:** 30-45s per round
Swim	**Frequency:** 2-3 days/week **Weekly Volume:** 1500-2225m **Structure:** 250-1675m/session 2-4 drils/session 25-50m/drill 2-7 reps/drill **Fin Day:** 5-7 x 125-225m **Treading Day:** 8x15-20s **Rest:** 180s	**Frequency:** 2-3 days/week **Weekly Volume:** 2700-3900m **Structure:** 250-1525m/session 4 drils/session 25-100m/drill 2-10 reps/drill **Fin Day:** 3-5 x 275-575m **Treading Day:** 4-5 x 30-75s **Rest:** 180s	**Frequency:** 2-3 days/week **Weekly Volume:** 3150-4400m **Structure:** 800-3000m/session 4 drils/session 25-300m/drill 2-8 reps/drill **Fin Day:** 2-4 x 650-1000m **Treading Day:** 4-5 x 90-120s **Rest:** 60-120s	**Frequency:** 3 days/week **Weekly Volume:** 3400-5400m **Structure:** 800-2400m/session 4-7 drils/session 25-500m/drill 1-4 reps/drill **Fin Day:** 1-2 x 875-1500m **Treading Day:** 1-2 x 150-180s **Rest:** 30-150s
Ruck/Load Carriage	**Frequency:** 1 day/week **Weekly Volume:** 1600-3200m **Ruck Pace:** 16:00/mile **Weight:** 0-20lbs	**Frequency:** 1 day/week **Weekly Volume:** 4000-4800 **Ruck Pace:** 15:00-16:00/mile **Weight:** 20lbs	**Frequency:** 1-2 days/week **Weekly Volume:** 4800-6400m **Ruck Pace:** 15:00-16:00/mile **Weight:** 25-30lbs	**Frequency:** 1-2 days/week **Weekly Volume:** 2400-4800m **Ruck Pace:** 15:00/mile **Weight:** 30-40lbs

to provide adequate adaptation while still allowing quality training to be conducted from session to session. Prioritizing an element of training on a certain day does not mean all others are not important, simply that the sessions are structured so that everyone is exposed to the appropriate stimulus regardless of time available while providing high-frequency exposures to most modalities of training on most days to assist in adaptive response. In many cases, schedules change, training facilities close, or life presents situations that are more important than training. By accomplishing what is most important first and most often, the preparatory process can be more effective over time and is more robust against the unexpected. See Table 2 for a breakdown of suggesting loading progressions within each training modality by phase.

WARM-UP AND PLYOMETRICS

The first task of each day will be preparing the body to train through a simple, yet comprehensive warm-up intended to stimulate the tissues to be trained that day to be resistant to impact and high-volume work demand of the stretch-shortening cycle (SSC). The concept of balancing the trainee's center of mass over their center of balance during the low-effort hops, skips, and jumps will be emphasized on most days. These plyometric movements will be progressed to more maximal versions, including external loading in the form of vests or hand-held dumbbell or kettlebells, while increasing speed and effort of movement to better mimic the types of loaded movements seen throughout AFPSECWAR training. Much of the warm-up will also consist of lateral and rearward movement to counteract the straight ahead, or linear, running volume necessary in this program. This general warm-up will be conducted 3 – 6 times per week, increasing in frequency and intensity as the trainee progresses through the program and slightly varied to provide novelty and necessary variety to each body part and movement pattern. Beginning at three low-intensity plyometric sessions per week and progressing to 5 – 6 per week has previously been established as an acceptable workload progression, while minimizing excessive joint and muscle soreness, even in rehabilitation settings (4). The total volume counts listed in Table 2 are inclusive of prescribed general warm-ups and the suggested hop, skip, or jump circuits contained within the main workout themselves.

These higher-frequency, low- to moderate-intensity plyometric sessions have been shown to elicit increases in bone density and connective tissue adaptation in both sexes (2,8,9,12). However, the research shows a generally impaired acute genetic translational response in women when compared to men (1,10). It would also appear that running alone, which is a common preparatory method for military selection courses, is insufficient to increase tendon and bone quality in women and the inclusion of multi-directional plyometric training would serve both sexes best, especially when training in a mixed-sex group where training cannot always be acutely adjusted to the individual (22). This preparatory training is also structured to enhance intramuscular and intermuscular elastic qualities, or the ability of the connective tissues and the constituent proteins within skeletal muscle to synergistically interact to provide passive and active tolerance to the impact stress incurs during running, load carriage, and any other task that may incorporate the SSC (17,21). Passive tolerance to load would be observed when the foot strikes the ground and the inherent stiffness of the muscle and connective tissues resist, store, and return energy through the lower extremity without the aid of muscular contraction.

Active resistance to the loading of ground impact is best observed when body positioning, timing, and coordination of the active muscular recruitment pattern is conducted in such a way that a majority of the muscular effort devoted to the activity is directly returned into the act of moving the body, usually best trained through frequency of exposure to tasks known to contribute to specific patterns of interest (4,16,17,21,23). When these elastic and coordinative qualities simultaneously contribute to the passive and active completion of work during running and load carriage, the training effect may serve to reduce chronic energy expenditure benefitting a trainee taking part in high-volume and long-duration training characteristic of AFSPECWAR occupational demands.

STRENGTH AND WORK CAPACITY

After the comprehensive warm-up, the next objective will be to prepare the individual to tolerate the total volume of work expected within this training pipeline. This will be accomplished by gradually increasing work volume throughout all aspects of the program to include strength training, swimming, running, and rucking. The strength training is designed to compliment those qualities to prevent injuries and build general strength needed to perform in the AFSPECWAR pipeline. Training loads are primarily increased in correlation with training frequency beginning with 2 – 3 days per week and progressing to four days per week, inclusive of body and loaded calisthenics alongside dumbbell or kettlebell loaded resistance training. Specific events or exercises are progressed accordingly to mirror future activities within the pipeline to aid in reduction of injury as well as increase performance and tactical readiness. As previously stated, there has been a trend identified of lower arm and elbow injury once training with ropes and rope ladders begins within the pipeline. To mitigate this risk, it is recommended to utilize a rope or towel attachment multiple times a week during pulling exercises to prepare the trainee for this demand. An example is provided within the example training week depicted in Table 3.

TABLE 3. EXAMPLE TRAINING WEEK

Week 19 of 20

Day 1

Swim Warm Up
5-10 min Individual Drills

Freestyle Swim

Meters	Reps	Rest Time
50	4	1:15
100	3	2:00
150	2	3:15
300	2	0:40
50	3	1:15
100	2	2:40
200	1	n/a

Extensive Run Warm Up
800m Hop/Skip/Jog Continuous

Intensive Plyometrics*

Exercise	Sets	Reps
12" Depth Broad Jump	4	3 to 5

Run

Meters	Reps	Time
200m	6	36-42s
Rest	Reps	Time
200m Walk	6	90s

Instructions
Run 200m in 36-42s. Walk back to start within 90s.

Day 2

Extensive Run Warm Up
800m Hop/Skip/Jog Continuous

LSD Run

Time	Pace	Meters
20min	~10-11 min/mi	~2900

Instructions
Maintain conversational pace; increase speed if 10min pace is too slow.

Strength Warm Up
Crawl Warm Up

Strength

Exercise	Sets	Reps
Deadlift	4	6

Strength Endurance Circuit 1*

Exercise	Sets	Clusters
Pull Up	2	4x4
Push Up	2	4x15
Inverted Row**	2	4x15
Side Bear Crawl	2	2x20m (L/R)

Strength Endurance Circuit 2*

Exercise	Sets	Reps
18" Lateral Step Up	4	7 Each Leg
Good Morning	4	14
Supine Bwt Row*	4	14
Burpee	4	20s

Accessory Circuit 3*

Exercise	Sets	Reps
Hamstring Curl**	2	7 each leg
Copenhagen	2	20s
Bicep Curl**	2	14
Burpee	2	20s

Day 3

Swim Warm Up
5-10 min Individual Drills

Freestyle Swim

Meters	Reps	Rest Time
200	5	2:30

Fin Swim

Meters	Reps	Rest Time
1350	1	n/a

Active Recovery
Option #1

Exercise	Min	Distance
Walk	20-30	Variable

Instructions
Take a leisurely walk, outside if possible. Keep heart rate <60% Max. Complete Hip and Shoulder Mobility.

Active Recovery
Option #2

Exercise	Min	Distance
Upright Bike	20-30	Variable

Instructions
Maintain Zone 1 Pace. Keep heart rate <60% Max. Complete Hip and Thoracic Mobility.

Active Recovery
Option #3

Exercise	Min	Distance
Rower	15-20min	Variable

Instructions
Maintain Zone 1 Pace. Keep heart rate <60% Max. Free stretch/foam rolling.

Day 4

Strength Warm Up
In Place Calisthenics Warm up

Strength

Exercise	Sets	Reps
DB Goblet Squat	4	6
DB Military Press	4	6

Accessory Circuit

Exercise	Sets	Reps/Time
Curtsy Lunge	4	6 Each
1-Leg RDL	4	6 Each
Plank	4	30s
Y-Raise	4	20
T-Raise	4	20

Extensive Run Warm Up
800m Hop/Skip/Jog Continuous

Intensive Plyometrics

Exercise	Sets	Reps
Skater Bounds	4	4 Each Leg

Run + Calisthenics Circuit

Meters	Sets	Time/Reps
400	4	90s
Push Up	4	25
Pull Up***	4	6
Inverted Row	4	25
Face Pull**	4	8
Bear Crawl	4	30s

Instructions
Rest 30s rest between exercises, 2min between sets. No vest.

Day 5

Swim Warm Up
5-10 min Individual Drills

Freestyle Swim

Meters	Reps	Rest Time
100	4	1:15
150	3	2:00
300	2	3:15
50	3	0:40
100	2	1:15
200	1	n/a

Tread

Time	Reps	Rest Time
2:45	1	n/a

Extensive Run Warm Up
800m Hop/Skip/Jog Continuous

LSD Run

Time	Pace	Meters
22min	~10-11 min/mi	~3000

Instructions
Maintain conversational pace; increase speed if 10min pace is too slow. Every fourth minute increase pace or 1-2 RPE, but return to conversational pace after 60s.

Day 6

Weighted Walk (RUCK) Warm Up
A. 400m Skip/Hop/Jog Continuous
B. 400m Skip/Hop/Jog Continuous*

Weighted Walk (RUCK)

Meters	Weight	Time
4800	35lb	48:00:00

Recovery Circuit

Exercise	Sets	Reps/Time
Supine Leg Raises	2	10 Each
Supine Knee Extension	2	10 Each
Glute Bridge @ 10" Knee Flexion	2	10
Side Lying Thoracic Rotations	2	10 Each
Supine Belly Breathing	2	30s
Prone Belly Breathing	2	30s

Optional Calisthenics Circuit

Exercise	Sets	Reps
Pull Ups***	1	50
Push Ups	1	120
Sit ups	1	120
18" Step Up	1	100 total

Instructions
Complete all reps of each exercise before moving to the next. Rest only as long as is needed, but do not go to failure. Pace yourself and get all repetitions completed.

* = Wear 20-25lb Vest
** = Use Suspension Trainer
*** = Use Towel Draped Over Pull Up Bar

Resistance training volume will be increased almost exclusively within the loaded and unloaded calisthenics sessions. This program feature is to provide adequate exposure to known stressors as well as limit global stress incurred through using greater absolute weights during axial-loaded barbell strength training. The inclusion of external load during the load carriage (rucking) and plyometrics program will constitute the bulk of axial loading present in the current program. Early in the program, the focus will be to complete all repetitions within the prescribed workout to standard, resting as necessary to complete the training session. As the trainee approaches the end of the preparatory program, the goal will be to meet the training volume of each set and session, only resting for the duration defined in the program. By increasing volume and decreasing rest, total work density will be increased to prepare the individual for the multiple bouts of strenuous exercise per day encountered in the formal training pipeline. An example training week has been included in Table 3, which outlines a possible structure for program delivery.

RUNNING AND RUCKING

Maintaining a balance between accumulating adequate training volume on the feet and conserving necessary bone, tissue, and metabolic adaptive capacity for the other training modalities can be facilitated by keeping exposure frequency relatively high (3 – 5 times per week) but keeping total session duration specific to running and rucking relatively lower, regardless of biological sex (12). As previously stated, straight-line running may not facilitate the protective adaptations necessary to reduce the risk of injury during training, so it is again recommended to incorporate movement in all directions during the dynamic warm-up before running or ruck training. These types of movements, such as lateral shuffles, backward pogo hops, 45-degree bounds, and split-lunge jumps, are key to ensuring robustness with the added benefit of exposure to diverse movement demands, which may also increase overall coordination and rhythm (16,23).

Specific run training is recommended at three days per week and ruck training is recommended at once per week early in the developmental period. The extensive and intensive plyometrics previously described and depicted in Table 2, which may occur at times independent of running or rucking, serve as additional load carriage preparation at magnitudes above and below those incurred during load carriage, while keeping total session volume down to reduce the risk of overuse-type injuries in those unaccustomed to these specific physical demands. The biological basis for this recommendation is identified in Part I of this series (13). Prescribed running paces are given in meters per second (m/s) and are recommended in relation to the demands of the courses early within AFSPECWAR physical training. Though maximal sprinting may be necessary within these career fields and the tactical train ups, it is difficult to gauge the exact velocities each unique individual will attain during short, fast running bouts and these types of activities should be scaled up under the supervision of an experienced professional. These conservative recommendations are geared toward the trainee who has not trained for speed or power-based sports performance and carries the intent to develop general capacities which are not present. Refer to Table 3 for example running interventions within a training week.

SWIMMING

Ensuring a potential candidate has pool access is vitally important for successful preparation. Each training course has a swimming component and those who are unable to meet and exceed minimum competency expectations will struggle to find success. The authors recommend beginning swim training is at two sessions per week, progressing to three total sessions each week with increased work density, which will ensure suitable exposure to begin more intensive swim training inherent to AFSPECWAR training. These training sessions will be characterized by shorter "sprint" type intervals, longer bouts to build work capacity, and a focus on either treading or fin swimming once a week per modality to ensure foundational ability when a prospective candidate begins their formal training. The authors stress that all swim training sessions should be conducted in the presence of a qualified lifeguard or certified swimming instructor familiar with the tasks that have been recommended within this program. Table 2 outlines recommended distances per repetition, workout structure, and overall volumes per day and per week.

FINAL THOUGHTS

If a trainee is unable to comfortably meet the weekly volume suggestions of each phase, it is not recommended to progress forward and instead to repeat that phase in all modalities with all prescribed program elements (e.g., rest intervals, difficulty, frequencies, and volumes). The time of each phase, 4 – 6 weeks, is provided as a soft guideline and more time may be necessary to meet these training demands and results should be guided by relative performance, not simply the length of each block of training. Understanding the link between injury and fitness in initial military courses of entry, it would be advantageous to prepare everyone to perform well above minimum standards at the onset of formal training, regardless of biological sex or background.

Enhancing the individual ability to recover and adapt may provide a smoother transition when the work volume and intensity increase within these training guidelines. A comprehensive guide to employing stress mitigation, sleep, nutrition, and recovery modalities (e.g., foam rolling, compression garments, cold-water immersion) can be found elsewhere (18). Promoting adequate energy availability, avoiding fad dieting, and managing the individual responses to stress while adhering to the program guidelines provided in this article may enhance the efficacy of training.

REFERENCES

1. Ansdell, P, Thomas, K, Hicks, K, Hunter, S, Howatson, G, and Goodall, S. Physiological sex differences affect the integrative response to exercise: Acute and chronic implications. *Experimental Physiology* 105(12): 2007-2021, 2021.

2. Beaupré, G, Orr, T, and Carter, D. An approach for time-dependent bone modeling and remodeling—Theoretical development. *Journal of Orthopaedic Research* 8(5): 651-661, 1990.

3. Butler, C, Haydu, L, Bryant, J, Mata, J, Tchandja, J, Hogan, K, and Hando, B. Musculoskeletal injuries during U.S. Air Force Special Warfare training assessment and selection, FY 2019–2021. *Medical Surveillance Monthly Report* 29(8): 2-6, 2022.

4. Chmielewski, T, Myer, G, Kauffman, D, and Tillman, S. Plyometric exercise in the rehabilitation of athletes: Physiological responses and clinical application. *Journal of Orthopaedic and Sports Physical Therapy* 36(5): 308-319, 2006.

5. Godhe, M, Helge, T, Mattsson, C, Ekblom, Ö, and Ekblom, B. Physiological factors of importance for load carriage in experienced and inexperienced men and women. *Military Medicine* 185(7-8): e1168-e1174, 2020.

6. Haff, G, and Triplett, N. (Eds.). *Essentials of Strength Training and Conditioning, 4th edition*. Champaign, IL: Human Kinetics; 2015.

7. Knapik, JJ, Bullock, SH, Toney, E, Wells, JD, Hoedebecke, E, and Jones, BH. Influence of an injury reduction program on injury and fitness outcomes among soldiers. *Injury Prevention* 10(1): 37-42, 2004.

8. Kubo, K, Ikebukuro, T, Yaeshima, K, Yata, H, Tsunoda, N, and Kanehisa, H. Effects of static and dynamic training on the stiffness and blood volume of tendon in vivo. *Journal of Applied Physiology* 106: 412-417, 2009.

9. Kubo, K, Ikebukuro, T, Maki, A, Yata, H, and Tsunoda, N. Time course of changes in the human Achilles tendon properties and metabolism during training and detraining in vivo. *European Journal of Applied Physiology* 112(7): 2679-2691, 2012.

10. Liu, D, Sartor, M, Nader, G, Gutmann, L, Treutelaar, M, Pistilli, E, et al. Skeletal muscle gene expression in response to resistance exercise: sex specific regulation. *BioMed Central Genomics* 11(1): 1-14, 2010.

11. Lloyd, R, Hind, K, Parr, B, Davies, S, and Cooke, C. The extra load index as a method for comparing the relative economy of load carriage systems. *Ergonomics* 53(12): 1500-1504, 2010.

12. Mata, JD, and Heydu, LE. Developmental model for prospective male and female US Air Force Special Warfare candidates: Part I – Background. *TSAC Report* 68: 12-17, 2023.

13. Nose-Ogura, S, Yoshino, O, Dohi, M, Kigawa, M, Harada, M, Kawahara, T, et al. Low bone mineral density in elite female athletes with a history of secondary amenorrhea in their teens. *Clinical Journal of Sport Medicine* 30(3): 245-250, 2020.

14. O'Leary, T, Wardle, S, Rawcliffe, A, Chapman, S, Mole, J, and Greeves, J. Understanding the musculoskeletal injury risk of women in combat: The effect of infantry training and sex on musculoskeletal injury incidence during British Army basic training. *British Medical Journal of Military Health* 0: 1-5, 2020.

15. Pegrum, J, Crisp, T, and Padhiar, N. Diagnosis and management of bone stress injuries of the lower limb in athletes. *British Medical Journal* 344: e2511, 2012.

16. Sakai, K, Hikosaka, O, and Nakamura, K. Emergence of rhythm during motor learning. *Trends in Cognitive Sciences* 8(12): 547-553, 2004.

17. Schleip, R, Naylor, I, Ursu, D, Melzer, W, Zorn, A, Wilke, H, et al. Passive muscle stiffness may be influenced by active contractility of intramuscular connective tissue. *Medical Hypotheses* 66(1): 66-71, 2006.

18. Shumway, J, and Johnson, A. Recovery strategies in Air Force Special Warfare training. *TSAC Report* 64: 12-16, 2022.

19. Tenforde, A, Carlson, J, Sainani, K, Chang, A, Kim, J, Diaz, R, and Fredericson, M. Lower trabecular bone score and spine bone mineral density are associated with bone stress injuries and triad risk factors in collegiate athletes. *Physical Medicine and Rehabilitation* 13(9): 945-953, 2021.

20. Tenforde, A, Parziale, A, Popp, K, and Ackerman, K. Low bone mineral density in male athletes is associated with bone stress injuries at anatomic sites with greater trabecular composition. *The American Journal of Sports Medicine* 46(1): 30-36, 2017.

21. Turrina, A, Martínez-González, M, and Stecco, C. The muscular force transmission system: Role of the intramuscular connective tissue. *Journal of Bodywork and Movement Therapies* 17(1): 95-102, 2013.

22. Westh, E, Kongsgaard, M, Bojsen-Moller, J, Aagaard, P, Hansen, M, Kjaer, M, and Magnusson, S. Effect of habitual exercise on the structural and mechanical properties of human tendon, in vivo, in men and women. *Scandinavian Journal of Medicine and Science in Sports* 18(1): 23-30, 2008.

23. Wymbs, N, and Grafton, S. The human motor system supports sequence-specific representations over multiple training-dependent timescales. *Cerebral Cortex* 25(11): 4213-4225, 2015.

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