

## Workshop Proceedings

# Expanded Air Force Physical Fitness Battery: Muscle Strength, Muscle Endurance, and Flexibility Considered

Prepared for: OFFICE FOR PREVENTION AND HEALTH SERVICES ASSESSMENT (OPHSA)  
ARMSTRONG LABORATORY  
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CSERIAC is a US Department of Defense Information Analysis Center, managed by the Defense Technical Information Center, Alexandria, VA, hosted by the Armstrong Laboratory, Human Engineering Division, Wright-Patterson Air Force Base, OH, and operated by the University of Dayton Research Institute.

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PROCEEDINGS

EXPANDED PHYSICAL FITNESS WORKSHOP

US AIR FORCE OFFICE FOR PREVENTION AND HEALTH  
SERVICES ASSESSMENT

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JULY 31, 1997 DAYTON, OHIO

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This *Proceedings* document summarizes the discussion that took place during the Expanded Physical Fitness Workshop, sponsored by the US Air Force Office for Prevention and Health Services Assessment and supported by the Crew System Ergonomics Information Analysis Center (CSERIAC), held at the Dayton Airport Inn, Dayton, Ohio, on July 31, 1997. The purpose of this meeting was to attain consensus among a group of subject-matter experts on the advantages and disadvantages to the Air Force of adding strength and flexibility components to its fitness program. Dr. Stefan Constable of the Air Force Fitness Science & Research office conducted the workshop and gave opening remarks. Barbara Palmer, of the CSERIAC Program Office, presented a briefing based on her *Review & Analysis* of these topics, entitled, *Expanded Air Force Physical Fitness Battery: Strength and Flexibility Considered*. Discussion followed, and the main points of this discussion are documented here.

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## STATEMENT OF GOALS

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The goal of the workshop was to seek consensus, opinions, and approaches on topics relevant to the Air Force's consideration of an Expanded Physical Fitness Battery. Specifically, these topics were:

*Muscle Strength and Muscle Endurance Training*

*Muscle Strength and Muscle Endurance Testing*

*Flexibility Training / Testing*

*Standards*

*Program Implementation*

*Suggestions / Issues*

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## MUSCLE STRENGTH AND MUSCLE ENDURANCE TRAINING

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### *Consensus*

Consensus was reached that muscle strength and muscle endurance training should be implemented by the USAF for health benefits as a minimum, and that the American College of Sports Medicine recommendations should serve as the basis for an Air Force strength-training program. The proposed statement, which is designed to promote adult fitness, is now in draft form to the ACSM committee, and recommends:

- 2 or 3 days of strength training per week
- 1 set of exercises
- 8-10 exercises per set
- Weight set to achieve volitional fatigue at repetitions below
  - 8-12 repetitions for personnel under 50 years of age
  - 10-15 repetitions for personnel 50 and older (lighter weights used)

Other considerations, such as training schedule, speed of repetitions, range of motion, and various training methods could be covered in a technical manual and/or handled by Installation Fitness Program Managers (IFPMs).

### *Other Points Covered*

Dr. Peterson emphasized that, whatever the training program, exercises should be done through a full range of motion, under control, and should develop antagonistic muscle groups.

Maj Snedecor and LCDR Hernandez indicated that emphasis should be on training and not testing.

Dr. Schlub indicated that the existence of a testing program encourages gym use.

Dr. Pollock suggested that compliance would be greater for a prescribed fitness program that takes less time.

Dr. Constable stated that program adherence will be less likely if the program requires equipment (e.g., strength training with resistance machines) than if it does not (e.g., aerobics), since equipment/facility availability may conflict with one's work schedule.



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## MUSCLE STRENGTH AND MUSCLE ENDURANCE TEST BATTERY

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### *Consensus*

The group for the most part agreed that a test battery should consist of three components, i.e., upper body, lower body, and abdominal evaluations. The following measures would constitute an appropriate muscle strength/muscle endurance test (1 RM refers to one repetition at the maximum weight possible):

- *1 RM bench press*
- *1 RM leg press*
- *Bent-knee sit-ups or curl-ups (crunches)*

### *Other Points Covered*

Discussion prior to the above agreement included descriptions of several other test batteries and related considerations.

An important point made by Dr. Pollock was that measures of muscle fitness are so highly correlated with one another that only a very small number of tests might be necessary. It was then stated that, for USAF purposes, muscle strength and muscle endurance are related to the degree that a measure of one should be a reasonable index of the other. Sit-ups as opposed to curl-ups (or crunches) were considered to be easier to accurately measure, since they have a definite start position and a definite end position.

Dr. Nieman described the Cooper Institute's FitCheck standards, the YMCA battery, and the Canadian Standard Test of Fitness. Maj Scully described the Fighter Aircrew Fitness Program, a recently devised program followed by Air Force fighter pilots. Dr. McDaniel described the USAF Strength Aptitude Test, which is used as part of the USAF's entrance requirements.

Dr. Nieman recommended that, whatever battery was decided upon, the order of tests be considered. He suggested that the submaximal aerobic test be administered first, with sit-ups at the end.

Dr. Pollock stated that factors to consider in test battery development are accessibility to equipment and adherence relative to a time commitment. Also to be considered are cost and ease of administration, predicted injury rate, and the ability to set a meaningful standard for a given test.

Dr. Nieman indicated that considerations in selecting tests are validity, reliability, ease of use, need for equipment, and existence of normative data.

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## FLEXIBILITY TRAINING/TESTING

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### *Consensus*

The workshop participants agreed that the Air Force should fully support flexibility training as part of the Expanded Physical Fitness Program, but the group concluded that testing would not currently provide significant benefits. The American College of Sports Medicine recommendation is an appropriate training model, and consists of:

- *At least 3 days a week of flexibility training*
- *10 to 30 seconds duration for each stretch*
- *Intensity should be to a position of mild discomfort*
- *3-5 repetitions of each stretch*
- *Slow and controlled stretches with emphasis on major joints and lower back and thigh area*

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## STANDARDS

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### *Consensus*

The workshop participants agreed that setting standards (pass-fail criteria) is a difficult task.

### *Other Points Covered*

Dr. Harman suggested that full body weight not be used in determining test standards; body weight to a fractional power is more appropriate.

Dr. Pollock suggested that an Air Force normative database is needed, and that data should be collected during pilot studies and after initiation of Air Force-wide testing.

Dr. Nieman recounted his experiences in trying to establish criterion-referenced standards for the YMCA's Fitness Analyst. The goal was to determine standards associated with good health.

Dr. Pollock also remarked that establishing a health-related standard is difficult, as is a task-performance-based standard.

Dr. McDaniel urged that if there are no scientific standards within the Air Force at this time, the standards of other organizations should be considered.

Dr. Harman urged some ultimate tie-in to job or task performance, as did Dr. Hodgdon.

LCDR Hernandez emphasized that the point of fitness guidelines is to encourage regular exercise, not to focus just on test performance.

Dr. Hodgdon hoped that in the future, standards will be occupation-based, and stated that any changes made by the Air Force can serve as incentives for changes in the Navy fitness program.

Dr. Schlub believes that a point system, as was used in some past military programs, would encourage training through self-motivation and competition.

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## PROGRAM IMPLEMENTATION

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### *Consensus*

The group agreed that determining a "best" strategy for program implementation is critical to achieve success. The "lessons learned" from the cycle ergometry fitness program component should be carefully noted. The group agreed that creation of a large database for cost benefit studies is most desirable, but until this is attainable, gym visits and other measures of program adoption, such as a change in fitness test scores or questionnaires, should be used as interim metrics.

### *Other Points Covered*

**Maj Baumgartner** emphasized the need for an *AF Exercise Manual* for use by AF members. Such a document would include specifics of test administration, explanations of the purpose of measures, and educational information on personal programs for lifestyle fitness.

**Dr. Schlub's** earlier comment on a point system led to a discussion of ways to motivate people to train. The Army's Master Fitness Trainer idea was put forth as a program to motivate adherence. A fitness competition such as that held at Hickam AFB was also discussed. Within-organization competitions could award ribbons, 3-day passes, and other incentives.

**LCDR Hernandez** described the Navy's experience with fitness programs that were the responsibility of the individual units.

**Dr. Peterson** suggested that a Master Trainer, as the Army has employed, could also serve as an information resource.

**Maj Scully** believes that the test itself encourages compliance, but that there are also positive motivators. He believes that command support is essential.

**Dr. Nieman** described a successful weight-loss competition, in which groups of dieters competed against other groups, under certain health constraints.

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## SUGGESTIONS / ISSUES

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### *Points Covered*

Dr. McDaniel suggested that an appropriate metric should be identified and ideally should be assessed before and after any change in the Air Force Fitness Program to see if a meaningful change had taken place as a result of the new program.

Dr. Nieman reminded the group of an earlier statement that gym use had gone up since introduction of the cycle ergometry test, and noted that increased physical activity is really the desired outcome of a fitness program. Number of gym visits or increased test scores could be an appropriate metric.

Dr. Harman said that a physically demanding Air Force task could be identified, and Air Force personnel could be tested before and after a year of the improved physical fitness program, to see if the physical fitness program affected task performance.

Dr. Pollock suggested that the Air Force could track the number of people who engage in strength training over time, using self-reports.

Dr. Skinner asked if there was a reporting system for time off work due to illness or disability.

Maj Snedecor replied that a large-scale database is being established that will include a wide range of health and fitness variables for all Air Force personnel.

Dr. Skinner stated that the development of a huge archival database would allow us to test certain assumptions, such as the belief that some AF units are fit enough for deployment through performance of daily tasks (e.g., civil engineering), while other units are not. While there is currently no data to confirm this, the database would easily allow between-occupation types of analyses to be performed.

Dr. Hodgdon suggested that it would be possible to categorize the AFSCs according to relative strength requirements. Data could be gathered regarding injury incidence as a function of AFSC. After the implementation of a strength-training program, the analysis could be repeated to see if injury rate decreases.

Dr. Nieman presented the notion that it may not be realistic to conduct an actual experiment to determine the effects of a strength-training program. However, the alternative is to use descriptive data, which contains many uncontrolled factors. He recommended instead that we rely on the scientific reports within the *Review & Analysis*, which show the connection between strength training and bone density, improved muscle tone, body composition, etc. Dr. Nieman emphasized that the goal of a fitness program is to get Air Force members to train

more and to improve their performance measure scores, and that such training would allow health benefits to accrue. For the Air Force to set up appropriate data collection that would stand up to peer review may just not be possible.

**Dr. Constable** agreed with this statement, and believes that a definitive metric may not be possible at this time. When the database that Maj Snedecor reported on is in place, it may be possible to do further analysis in terms of a decrease in health-costs or injuries.

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## SUMMARY

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Dr. Constable summarized the significant progress of this workshop. Key points were:

- Suggested *Executive Summary* changes were agreed upon.
- Group reached consensus that adding a muscular fitness component to the current fitness test battery would be most appropriate for the Air Force, at least for its health benefits.
- Group reached consensus that the muscular fitness test battery would consist of upper body, lower body, and abdominal strength/endurance measures, specifically, sit ups or curl-ups (crunches), bench press, and leg press.
- Education regarding flexibility benefits and endorsement of ACSM flexibility training guidelines are appropriate.
- Group determined that adding flexibility to a test battery was not workable due to insufficient test measures.
- Decisions regarding norms or standards are yet to be made.
- Ideally, while it would be desirable to have a quantitative measure of the success of the program, for the short run such metrics as test battery scores and number of gym visits might be considered appropriate.
- Still of significant concern are resourcing, implementation, cost of equipment, acceptance, and load on Installation Fitness Program Managers (IFPMs).