



How Design, Fit and Adjustment of Aircrew Flight Equipment Improves Pilot Safety and Performance

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SCOPE OF PAPER

- **How poorly fitting Fast Jet Aircrew Equipment Assemblies (AEA) has a negative impact on Performance, Protection and Comfort of both Male and Female aircrew.**
- **Incorrect collection and use of anthropometric data increases the risk of injury during flight, ejection and post ejection scenarios.**
- **Poorly fitted AEA reduces pilot performance and mobility and increases fatigue of aircrew.**
- **In-water AEA performance can be compromised by incorrectly adjusted LPU's leading to increased risk to survivability.**

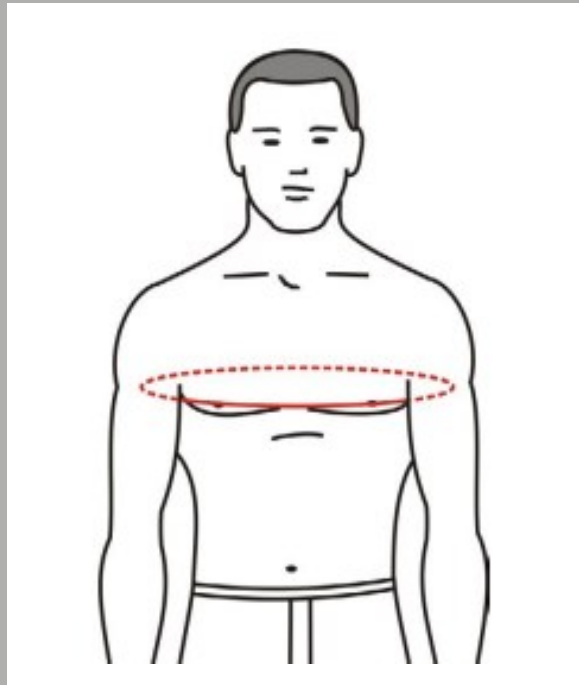
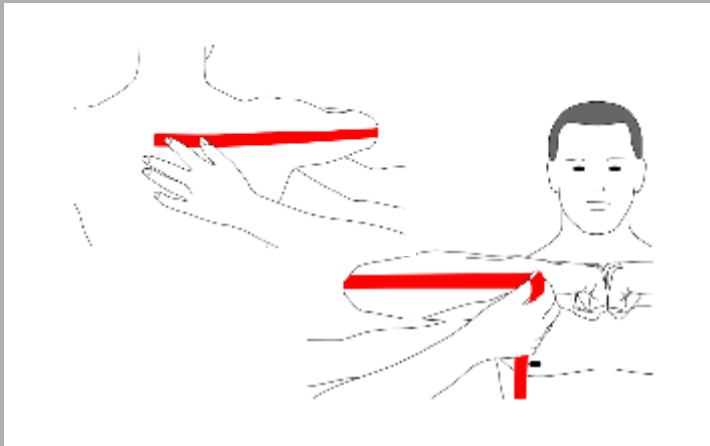
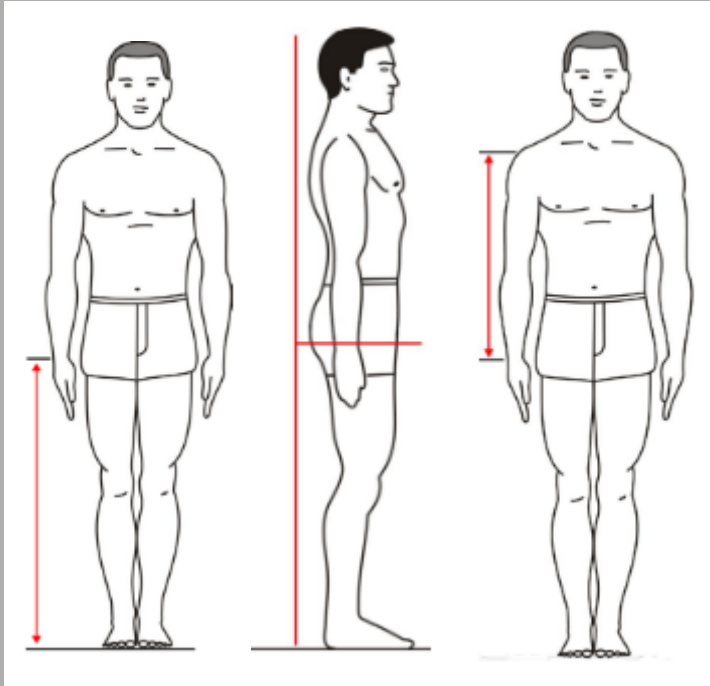
INTRODUCTION TO SURVITEC

- Market Leader in the development and supply of Fast Jet AEA solutions for over eight decades.
- Qualified and in service on many 4th and 5th generation Fast jets and Training Aircraft including Eurofighter Typhoon, F-35 Lightning II, KF-21, Hawk and PC-21.
- Keeping Fast Jet pilots comfortable, safe and protected throughout all phases of flight and ejection.
- Over 2000 F-35 pilots equipped with optimised AEA through our unique “Perfect Fit in 10 Days” programme.





CORRECT SIZING AND FITTING IN RELATION TO UPPER LIMB INJURY, G PROTECTION AND IN-WATER PERFORMANCE



AEA SIZING CONSIDERATIONS

- Accurate and consistent measuring methods and utilization of common anthropometric data points is essential.
- Survitec experience has identified a wide range of discrepancy in anthropometric data collection by end users leading to inaccurate AEA sizes being selected for issue.
- Survitec utilizes 15 measurements to accomplish the proper fit.
- Survitec have amassed extensive experience in pilot anthropometrics and fit challenges including unique compilation of an extensive US pilot anthropometric data base of **2081 male and 37 female pilots** through our Pilot Fit Facilities.



FITTING AND ADJUSTMENT CONSIDERATIONS

- Essential fitting and adjustment criteria needs to be determined during Equipment Development and System Integration of integrated clothing systems.
- If correctly sized AEA is badly fitted and adjusted, it may not operate correctly and provide the functionality and protection required.
- Correctly trained personnel are required to complete this part of the process
- Experienced flight equipment personnel from all military services hired, trained through in-dept training program to ensure all pilots are safely outfitted to meet all operational environment requirements



ANTI-G PROTECTION

- Incorrect measuring and fitting of the Anti G garment can lead to several issues that directly impact on pilot ability to fully exploit the agility and maneuverability of modern combat and training aircraft.
- The key issues will manifest themselves as;
 - Inadequate G protection – increased risk of G-LOC
 - Increased fatigue due to increased AGSM effort
 - Discomfort
 - Restricted mobility
 - Injury - petechia and bruising
- Sustained protection up to 9G can be achieved with correctly fitted Anti-G garments.



Anti-G Protection

- Select Anti-G garments that are available in a size roll covering a wide range of standard pilot sizes, Male and Female.
- Train ALSE specialists to measure accurately and record the data.
- Use selective fitting to validate anthropometric measurements gathered.
- Ensure garments are correctly adjusted by a trained ALSE specialist, do not leave this part to the pilot.
- Where a standard size doesn't fit correctly don't compromise, use a special measure garment.



FLIGHT JACKET AND LIFE PRESERVER

- **Contributing factors to performance**
 - Design drivers – comfort, mobility and functionality
 - Performance drivers – damage resilience, system redundancy, self righting, mouth freeboard, angle of floatation/face plane
- **Critical factors**
 - Close retention of the buoyancy against the body
 - Attachment point positions on the body
 - Stole shape, gas volume and pressure
 - Predictable and repeatable LPU performance in all sea states
 - Prevention of water ingestion (spray hood)
 - Life raft boarding

LIFE PRESERVER PERFORMANCE

- A badly fitted / integrated LPU will not provide the optimum self-righting characteristics – risk of drowning increased.
- Removal of the variability of the position of the LPU after inflation seen on some older LPU designs achieved by using improved mounting techniques that reduce movement of the LPU on the flight jacket – straps and cords not used in latest generation of AFE.
- Profiling of the LPU lobes will ensure self righting of the subject into the correct stable position with adequate mouth freeboard, head support and angle of floatation.



EVOLUTION OF ATTACHMENT AND ADJUSTMENT

- Some legacy LPU designs provide inadequate fixing solutions that allows the LPU to move around and when inflated does not positively force the subject into the correct position to reduce the risk of drowning.



Fixed points for LPU attachment positioned to optimise LPU retention and to promote correct angle of floatation.

Chest adjustment to ensure inflated LPU is held in static position close to the body

Waist adjustment retain the LPU attachment points securely to the waist to minimise “ride up” of the waistcoat – further improved by the use of a crotch strap



FLIGHT JACKET / LIFE PRESERVER



- Ensuring a Perfect Fit
 - Select Flight jackets that are available in a size roll covering a wide range of standard pilot sizes and configurable for different mission profiles.
 - Ensure a wider range of adjustment is provided to enable better levels of adjustment.
 - Ensure loss of adjustment is not possible over time.
 - Train ALSE specialists to measure accurately and record the data
 - Use selective fitting to validate anthropometric measurements gathered.
 - Ensure garments are correctly adjusted by a trained ALSE specialist, do not leave this part to the pilot
 - Where a standard size doesn't fit correctly don't compromise - use a Special Measure garment.

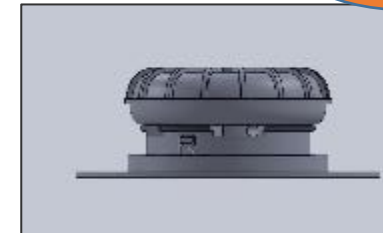
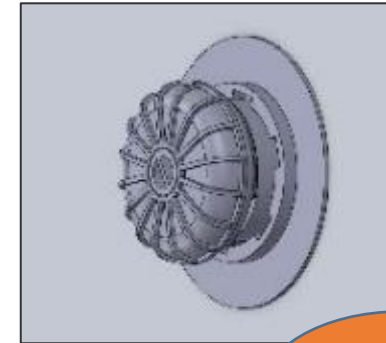
IMPROVED ADJUSTMENT FACILITY

Replacement of legacy lacing systems.

Development of a new ratchet / capstan adjustment system for garment fine adjustment.

BENEFITS:

- User friendly, ease of adjustment
- Rapid adjustment
- Positive locking to prevent slippage
- Adjustment provision to accommodate various body shapes
- Upper and lower adjustments to accommodate female fit
- Comfortable when adjusted
- Reduced maintenance burden



Patent Pending



CONCLUSION

- Accurate pilot anthropometric data collection will allow future generations of AEA to be designed to optimise fit and performance.
- Correct AEA design plus proper sizing fitting and adjustment = increased comfort, performance and safety.
- A wider range of adjustment built into the garment is essential to achieve a perfect fit with predictable behaviour.
- Attachment of LPU using fixed / no-slip / no-stretch securing points ensures the desired adjustment does not change over time.
- Trained ALSE specialists are key in achieving improved AEA fit and performance.
- Investing in a process where aircrew are accurately measured and fitted with AEA results in increased safety and performance with reduced injury claims.



