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Ergonomics Assessment of the "Ultra/U TOP" Laptop Stand

Prepared for Mr. John Andrews
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Note:

This report and the work it describes were undertaken by the Health and Safety Laboratory under contract to Mr. John Andrews, Ergonomic Café, Aberffraw, Anglesey. Its contents, including any opinions and/or conclusions expressed or recommendations made, do not necessarily reflect policy or views of the Health and Safety Executive.

HSL Job No.

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Request Date 28.03.05

Report Date 05.04.05

Distribution: Mr. John Andrews

Ergonomics Assessment of the Prototype Ultra & U TOP Laptop Stand

1. Introduction

The Health & Safety Laboratory's ergonomics specialists were approached by Mr. Andrews to provide an ergonomics assessment of the Ultra & U TOP laptop stand product and provide a letter report outlining the findings of the assessment. The current HSE guidance on the use of DSE equipment, "Work with display screen equipment" L26¹ points out that "Laptops [are] subject to the DSE regulations if it in prolonged use (Appendix 3, Page 52, Para 1). Attention shall be given to whether the Ultra & U TOP laptop stand product is expected to assist users in compliance with the DSE Regulations and also accepted good practice.

2. Observations

The Ultra & U TOP laptop stand alters the conventional horizontal orientation of a laptop computer to a more upright position when used on a work surface or a desk, so allowing adjustability in the height of the screen and the distance of the screen from the user, through the introduction of a peripheral keyboard. This re-orientation provides several advantages to the user compared to working with the laptop in a standard flat position, each of which shall be detailed in the following section:

2.1 Adjustable screen height

The greatest benefit to the user of the Ultra & U TOP laptop stand (hereby known as "Ultra & U TOP") is the ability to adjust the screen height to a raised level than could otherwise be achieved and so reduce the flexed neck posture. Bending the neck forwards is common while working on laptop computers due to a screen fixed only 5cm above the worktop with adjustability in angle only. Prolonged use of the laptop in this arrangement may lead to increased prevalence of neck aches, fatigue and possible more serious disorders, with up to 24% of office work related bodily aches being situated in the neck and shoulders². In order to provide individual users with a comfortable neck posture, adjustability in screen height is essential, both to allow a single user to alter the screen height when sitting on a variety of work surface/chair arrangements, and to provide a good general fit of the hardware to the greatest range of users. Many laptop stands do provide height adjustability, for example where the laptop is positioned on inverted square trays and more trays may be added to raise the height of the laptop, but such systems are not designed to be mobile or compact.

Ergonomics literature¹⁺²⁺³⁺⁴ recommends that the vdu screen be positioned such that the top of the screen is situated at the approximate eye level of the user so that the central

¹ HSE Books; Work with display screen equipment, Guidance on Health and Safety (Display Screen Equipment) Regulations 1992 as amended 2002; L26; Crown Copyright; 2003.

² Granjean, E. and Kroemer, K.H.E.; Fitting the Task to the Man, A textbook of Occupational Ergonomics 5th Edition, Taylor and Francis 2000.

³ Granjean, E. and Kroemer, K.H.E.; Fitting the Task to the Man, A textbook of Occupational Ergonomics 5th Edition, Taylor and Francis 2000.

area of the screen is slightly below the horizontal line of sight. In order to achieve this for all individuals, a certain degree of adjustability is required.

The range of adjustability of the screen height available using the Ultra & U TOP was measured using a standard laptop computer with a 29 x 21.5 cm screen situated on the Ultra & U TOP laptop stand. The overall range of adjustability provided by the Ultra & U TOP was 480mm - 415mm from the work surface to the top of the screen, as is illustrated in the following figure.

Figure 1: Showing the range of height adjustability from the work surface to the top of the screen of a laptop situated on the Ultra & U TOP stand.

⁴ Pheasant, S; Anthropometrics; BSI; 1990.



When placed on a desk (700mm high to the upper surface) the increased height and adjustability afforded by the Ultra & U TOP ensures that the *centre* of the screen falls between 1104 – 1169 mm from the floor. This range of heights falls well within the preferred ranges obtained in ergonomic laboratory studies, which are summarized as 780 – 1180 mm from the floor⁵.

⁵ Grandjean, E.; Ergonomics in Computerised Offices; Taylor and Francis; 1987.

HSE Guidance on DSE outlines the need to set the screen height and angle to allow comfortable head position and the Ultra & U TOP laptop stand does help the user to achieve this.

2.2 Horizontal distance to the screen

There are two ergonomics issues relating to the horizontal distance of the laptop screen from the user. The first relates to the distance to the screen from the users' eye point, and whether the user can comfortably see what is displayed. The user can adjust this, usually by moving the screen forwards or backwards on the surface. Ergonomics literature⁶ suggests that a distance from the front edge of the desk to the screen should be within the range of 500 – 750mm for a standard CRT screen. This may be less for an LCD screen as found on a laptop computer due to display contrast and character size differences.

Once the horizontal screen distance is set, the remaining area available in front of the laptop is now used to position the keyboard. HSE Guidance on DSE points out that there is a requirement for “space in front of the keyboard to support hands/wrists during pauses in keying”. There are often numerous requirements for this work surface space between the laptop computer and the user, such as for the laptop keyboard, the edge of the laptop stand, the peripheral keyboard and then space on which to rest the wrists. The Ultra increases the available space by orientating the laptop keyboard at an angle, reducing the laptop's horizontal footprint on the worktop leaving a greater amount of space for the peripheral keyboard to be positioned according to the comfort needs of the user. This is illustrated in Figure 2 on a laptop that would normally have a footprint measuring 250 mm from the front of the laptop keyboard to the front of the screen. On the Ultra & U TOP, this footprint is reduced to as little as 170mm, providing an extra 80 mm than would a flatly orientated keyboard.

Figure 2: Showing the diminished horizontal footprint of the laptop situated on the Ultra & U TOP stand.



Figure 1 U TOP



Remembering that the minimum viewing distance from the screen should be around 500mm, and given that the peripheral computer keyboard measures approximately 155mm from front to rear and the Ultra measured 200mm (max), the Ultra laptop stand allows the user an approximate minimum space of 145mm in front of the keyboard to position or support his or her wrists. (i.e. 500mm (min. recommended distance) – (keyboard depth + Ultra depth) = 120mm). Where the keyboard of the laptop orientated horizontally, as is often the case with laptop stands, this space afforded for the wrists would have been only 85mm.

HSE's guidance does not issue prescriptive means by which any display screen equipment must be laid out, but it does give general guiding principles that should be considered when assessing a workstation. In the case of the provision of adequate space in front of the keyboard to rest the upper limbs, which is in part made available by the small horizontal footprint of the laptop while situated in the Ultra stand, the product does concur with known good ergonomic practise and will better enable the user to set up the workstations according to the principles expressed in the HSE's guidance.

2.3 Storage and Transportation

A beneficial aspect of the Ultra & U TOP design is the ease of storage and transportation. The stand is the thickness of cardboard and folds flat to fit easily inside a laptop bag or briefcase alongside the laptop. This can be seen in the following illustration of the Ultra & U TOP in its closed position.

Figure 3: Showing the Ultra & U TOP stand in its closed position (with pen for size reference).



Figure 2 ULTRA



Figure 3 U TOP

3. Conclusion

The performance of the Ultra & U TOP laptop stand has been compared against established ergonomics guidelines for display screen equipment based work and the HSE's Guidance on the Display Screen Equipment Regulations¹. The Ultra & U TOP laptop stand enables the user to better follow the principles expressed in the above in terms of the physical arrangement of display screen workstation by raising the screen height and increasing available worktop space.

