

**Chief Manufacturing**  
**Flat Panel Display Arm Evaluation**  
**Report**

**Evaluated  
by  
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**May 21, 2004**

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## **INTRODUCTION**

A comparative ergonomic evaluation of 8 different brands of height-adjustable, articulating flat panel display mounts was performed on April 27, 2004 at the Chief Manufacturing plant in Savage, MN. The purpose was to collect comparative information on the various models of display mounts, which could be used in marketing efforts and future design improvement efforts. The evaluation was performed by David J. Dixon, Ph.D., an ergonomist and usability specialist with 20 years experience in assessing the usability of computer hardware and software.

## **METHOD**

Flat Panel arms were evaluated at the Chief Manufacturing plant in a conference room. All arms were installed on a table and were evaluated with a 10-lb. flat panel monitor attached. The various models were evaluated in a random order. Models were evaluated on height adjustment, tilt, positioning, and installation features. In addition, a force gauge was used to measure the force required to move the flat panel upward from approximately 10 inches above the table to the top of their horizontal range. Several readings were taken for each model and the average is reported.

The mounting mechanism was evaluated for stability and ease of installation by visual inspection and manually checking the mounting.

In addition to the evaluation methods above, each model was videotaped in a static position and while being adjusted to a typical working position.

## **RESULTS**

Results are presented in the Evaluation Worksheets, which follow. In addition, a comparative table is appended at the back of this report. This table presents summaries of ratings and data upon which these ratings are based.

## **CONCLUSIONS**

Based on the results of the evaluation, the Chief model FCG-110 display panel arm is superior to the other brands evaluated. The Ergotron model 28-171-200 and the SpaceCo model SA01 were judged to be quite good, but not as good as the Chief model. This is due primarily to the ease of positioning the Chief model in 3 dimensions with a single motion. The other models require the user to first position the display in one dimension (such as height) and then adjust the other dimensions (depth, horizontal placement).

The WorkRite model OS-1478 was judged to have the worst usability and ergonomics of the models evaluated due to the difficulty of adjusting the height and the design of the locking ring.

## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** Innovative Office Products Model 3500



**List Price:** \$279

**Overall Rating:** Fair

**Height Adjustment Rating:** Very Good

**Height Adjustment Range:** 0 to 11-5/8 inches

**Height Adjustment Ease of Use:** Very Good

**Force Required to Raise Display:** 4.8 lbs.

**Tilt Rating:** Fair

**Tilt Adjustment Range:** 45 degrees forward; 90 degrees back

**Tilt Ease of Use:** Fair

**Positioning Rating:** Fair

**Positioning Adjustment Range:** 0 to 27 inches front to back

**Positioning Ease of Use:** Fairly easy in one dimension

**Installation Rating:** Fair

**Comments:** Relative easy to move in one dimension, but extremely difficult to move in 2 or 3 dimensions simultaneously. No aid or tool is provided to help with installation to desk.

## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** Ergotron, Model 28-171-200



**List Price:** \$325

**Overall Rating:** Very Good

**Height Adjustment Rating:** Fair

**Height Adjustment Range:** 0 to 15 inches

**Height Adjustment Ease of Use:** Fair

**Force Required to Raise Display:** 12.7 to 13.8 lbs.

**Tilt Rating:** Very Good

**Tilt Adjustment Range:** 90 degrees front; 90 degrees back

**Tilt Ease of Use:** Easy

**Positioning Rating:** Very Good

**Positioning Adjustment Range:** 6.5 to 25 inches back to front

**Positioning Ease of Use:** Easy

**Installation Rating:** Very Good

**Comments:** Very easy to position screen in one dimension; difficult when orienting it in more than 1 dimension.



## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** Human Scale, Model M7322

**M7** Desk Mount  
Monitor Arms  
(1-2 Monitors)



**List Price:** \$440

**Overall Rating:** Very Good

**Height Adjustment Rating:** Fair

**Height Adjustment Range:** 6 to 14 inches

**Height Adjustment Ease of Use:** Fair

**Force Required to Raise Display:** 10 lbs.

**Tilt Rating:** Very Good

**Tilt Adjustment Range:** 53 degrees forward; 22 degrees back

**Tilt Ease of Use:** Very Good

**Positioning Rating:** Very Good

**Positioning Adjustment Range:** 8 to 21 inches back to front.

**Positioning Ease of Use:** Very Good

**Installation Rating:** Fair

**Comments:** On height adjustment, the entire weight of the monitor and arm must be raised. Limited height range compared to other models. Clamp to desk does not seem very secure; it almost came off of table as display position was adjusted. Locking ring for height adjustment requires moderate force to tighten.

## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** Idea @ Work, Model MA-1500B



**List Price:** \$

**Overall Rating:** Poor

**Height Adjustment Rating:** Very Good

**Height Adjustment Range:** 0 to 11.5 inches

**Height Adjustment Ease of Use:** Fair

**Force Required to Raise Display:** 6.3 lbs.

**Tilt Rating:** Fair

**Tilt Adjustment Range:** 40 degrees front; 50 degrees back

**Tilt Ease of Use:** Fair

**Positioning Rating:** Fair

**Positioning Adjustment Range:** 19 to 26.75 inches

**Positioning Ease of Use:** Fair

**Installation Rating:** Very Good

**Comments:** Difficult to move in 2 or more dimensions. Nice jointed latch, which tilts up 90 degrees to facilitate tightening without a tool.

### FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** SpaceCo, Model SA01



**List Price:** \$

**Overall Rating:** Very Good

**Height Adjustment Rating:** Very Good

**Height Adjustment Range:** 0 to 12.5 inches  
**Height Adjustment Ease of Use:** Very Good  
**Force Required to Raise Display:** 3.5 lbs.

**Tilt Rating:** Excellent

**Tilt Adjustment Range:** 60 degrees front; 90+ degrees back  
**Tilt Ease of Use:** Very Good

**Positioning Rating:** Excellent

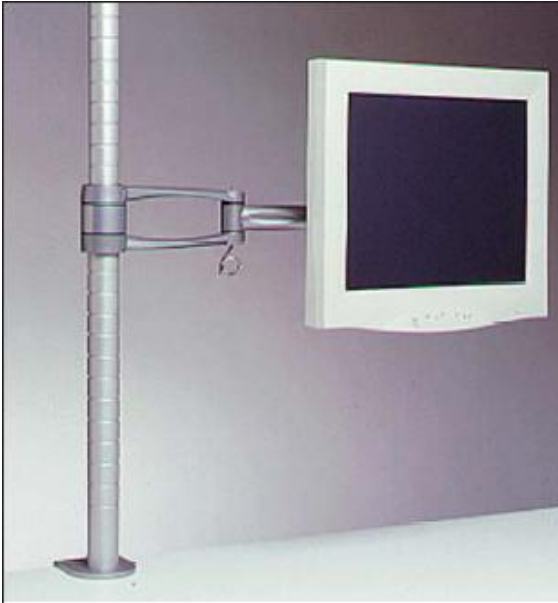
**Positioning Adjustment Range:** 3 to 24 inches  
**Positioning Ease of Use:** Excellent

**Installation Rating:** Very Good

**Comments:** Nice action when positioning display. In side-to-side positioning, the long arm feels like it is pushing the display toward the user. Watch out for smashed fingers when positioning due to the placement of the pivots. Cable management system included.

## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** CBS Wishbone/Standard



**List Price:** \$

**Overall Rating:** Fair

**Height Adjustment Rating:** Poor

**Height Adjustment Range:** 0 to 8.5 inches

**Height Adjustment Ease of Use:** Poor

**Force Required to Raise Display:** > 14 lbs.

**Tilt Rating:** Very Good

**Tilt Adjustment Range:** 65 degrees forward; 65 degrees back

**Tilt Ease of Use:** Fair

**Positioning Rating:** Very Good

**Positioning Adjustment Range:** 7.5 to 20 inches  
**Positioning Ease of Use:** Very Good

**Installation Rating:** Very Good

**Comments:** Very easy to adjust in all dimensions except height. Raising the height required moving a large O-ring up or down and then raising or lowering the entire arm. Very stable platform.

### FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** WorkRite, Model OS-1478



**List Price:** \$

**Overall Rating:** Fair

**Height Adjustment Rating:** Poor

**Height Adjustment Range:** 0 to 13 inches  
**Height Adjustment Ease of Use:** Poor  
**Force Required to Raise Display:** 14+ lbs.

**Tilt Rating:** Fair

**Tilt Adjustment Range:** 35 degrees forward; 40 degrees backward

**Tilt Ease of Use:** Fair

**Positioning Rating:** Fair

**Positioning Adjustment Range:** 6 to 21 inches

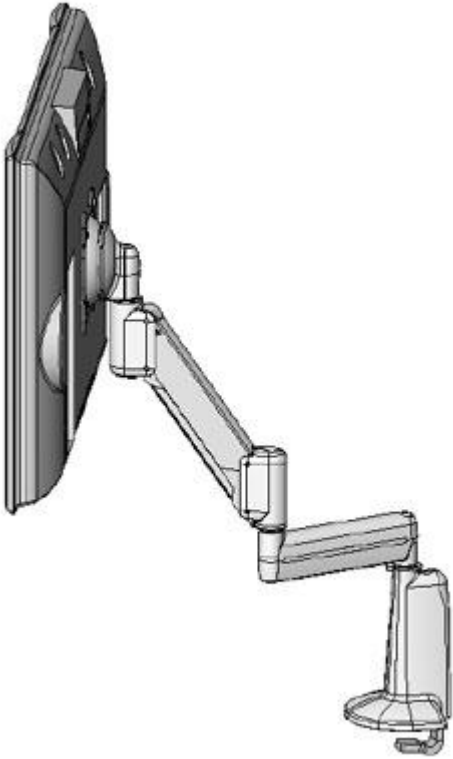
**Positioning Ease of Use:** Fair

**Installation Rating:** Fair

**Comments:** To change height the user must release locking ring, which can be difficult. The finger access to the locking mechanism for the arm is marginal and difficult to activate when too close to the mounting post. The display can be raised or lowered after the locking ring is loosened, but the user must use both hands to support the weight of the display and the weight of the arm. The locking ring should be re-designed to be larger with a larger locking mechanism handle. The icon indicating whether the height adjustment ring is locked is difficult to see because it lacks contrast with the background color.

## FLAT PANEL ARM EVALUATION WORKSHEET

**Manufacturer & Model:** Chief Manufacturing, Model FCG-110



**List Price:** \$375

**Overall Rating:** Excellent

**Height Adjustment Rating:** Excellent

**Height Adjustment Range:** 1 to 14 inches  
**Height Adjustment Ease of Use:** Excellent  
**Force Required to Raise Display:** 4.6 lbs.

**Tilt Rating:** Very Good

**Vertical Tilt Adjustment Range:** 18 degrees forward; 13 degrees back

**Tilt Ease of Use:** Excellent

**Positioning Rating:** Excellent

**Positioning Adjustment Range:** 4 inches to 21.5 inches

**Positioning Ease of Use:** Very easy

**Installation Rating:** Excellent

**Comments:** Very smooth movement action. Can be adjusted in 2 or more dimensions at the same time with relative ease. Components can be traded out to avoid obsolescence. Mounts from the top using a C-clamp type mechanism which does not require user to get behind or under the desk/table.

## COMPARATIVE EVALUATION TABLE

Ergonomic Flat Panel Arm Ratings		Excellent	Very Good	Fair	Poor					
Manufacturer and Model	List Price	Overall Score	Height Adjustment	Range	Ease	Tilt and Positioning	Range	Ease	Installation	Vertical Force Required to Raise Monitor
<b>Desk Mount Models</b>										
Chief FCG-110	\$375	Excellent	Excellent	1-14"		Very Good	F/B: 4-21.5"; Tilt: 18F, 13B	Excellent	Excellent	4.6 lbs
Ergotron 28-171-200	\$325	Very Good	Fair	0-15"	Fair	Very Good	F/B: 6.5-25"; Tilt: 90F, 90B	Very Good	Very Good	12.7-13.8 lbs
Human Scale M7322	\$440	Very Good	Fair	6-14"	Poor	Very Good	F/B: 8-21"; Tilt: 53F, 22B	Very Good	Fair	10 lbs.
Innovative Office Products Model 3500	\$279	Fair	Very Good	0-11.62"	Very Good	Fair	F/B: 0-27"; Tilt: DNM	Fair	Fair	4.8 lbs.
Idea @ Work MA-1500B	?	Poor	Very Good	0-11.5"	Fair	Fair	F/B: 19-26.75"; Tilt: 40F, 50B	Fair	Fair	6.3 lbs.
SpaceCo SA01	?	Very Good	Very Good	0-12.5"		Excellent	F/B: 3-24"; Tilt: 60F, 90+B		N/A	3.5 lbs
CBS Wishbone/Standard	?	Fair/Poor	Fair	0-8.5"		Very Good	F/B: 7.5-20"; Tilt: 65, 65B		Very Good	>14 lbs.
WorkRite OS-1478	?	Fair	Very Good	0-13"		Fair	F/B: 6-21"; Tilt: 35F, 40B		Fair	10 lbs.

**Comments:** Note: Tilt  
Measurements  
are in Degrees  
forward and  
backward from  
a reference of  
90 degrees  
vertical.

DNM=Di  
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measur  
e