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**From:** PAS

**Project:** Plasma Arc Speaker

**Subject:** Pairwise Comparison

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Four concepts were analyzed using the objectives of safety, operation force, sound level, and cost. From the previous concept memo, concept variants (CV) 1, 2, 6, and 8 were chosen for evaluation.

The concepts are scored on a 0-5 scale for safety. 0 is a guarantee that someone will be shocked by the device, while 5 means there is no chance a user will be shocked. Concepts which isolated the arc best and kept operators as far away as possible scored the highest.

Operation force is an engineering estimate of the amount of force required to operate the mechanical device used to lower and raise one of the electrodes. Spring concepts require more force (15 N), while the rack and pinion concept requires the least force (5 N). The concept with the hand crank moving the entire top electrode requires a midrange force (10 N).

Sound level is an engineering estimate on the decibel (dB) level each concept would output at a distance of one foot from the speaker. The directional sound concept scored the best on sound level (80 dB), while the 360 degree sound concepts all scored lower (60-65 dB) because the amount of power used cannot produce quality sound in all directions.

The cost values selected reflect the estimated material cost. The same electrodes will be used in all devices so the only factors affecting cost are the enclosure and the mechanical device. More complex mechanical devices and larger enclosures result in higher costs ($60-$80).

Breakeven points in the comparison are midrange values giving an acceptable concession to meet the lower objective. Operation force ranks higher than sound level with a value of 10 N as a middle ground to meet the sound level importance. Sound level ranks above safety with a value of 70 dB chosen to meet safety. Safety ranked higher than cost and is only lowered to 3 out of 5 due to the inability to concede safety to cost given the dangers of the plasma arc.

Operation force amounts to half of the total weight of importance since the mechanical device is one of the main focuses of design. Sound level followed with a value around one-quarter of the importance weight because any design produced changes sound level. Safety and cost are next with values less than one-quarter of the importance weight. Safety is limited due to the unsafe nature of the arc. Cost ranks last because all of the designs will fall under budget and are similar in total cost.

The final rankings listed CV 6 as the highest with CV 8 close behind, and CV 1 and 2 next, respectively.