Target Catalog

Table C-1 shows all the targets and metrics, linked to their corresponding function, that will be used to determine which design idea best meets the customer's needs.

Table C-1

Function	**Targets**	**Metric**
Ease of Attaching Device	Maximum Average Time to Attach Device with Integrated Wetsuit	8 min
	Maximum Average Time to Attach Device Without Integrated Wetsuit	1 min
Protects Device Against Corrosion	Minimum Number of Dives Before Equipment Needs Servicing	1 year or 25 dives whichever comes first
	Minimum live expectancy of device	5 years
Protects Diver Against Abrasions and Stings	Minimum Thickness of a Wetsuit	3 mm
	Maximum Amount of Exposed Skin in Lower Extremities	100 cm^2
Afford Safe Body Temperature	Maximum Time That Diver Can Stay Submerged in 14.5^oC Water	1.5 hr
Provide Means to Dive Independently	Minimum Angle of Diver at Surface	90^o
	Maximum Angle of Diver at Desired Diving Depth	0^o
Allows Diver to Reach Controls with Hands	Distance to Controls Must Not Exceed	672 mm
Prevent Interference with Obstacles	Diameter That Will Form Protective Perimeter Around Diver	998 mm
Decreases Drag	Limit Surface Area That Would Affect Forward Moving Diver's Drag to the Area Found Using the Diver's Shoulders as Diameter	# m^2 (Relative to Diver Observed)
Provide Smooth Transition in and Out of the Water	Maximum Weight of Equipment	4.5 kg
	Maximum Distance Device Extends from Wetsuit	30 cm
Provide Accessible Controls	Distance to Controls Must Not Exceed	672 mm

Operates Under Various Water Pressures	Maximum Pressure Able to Withstand	222.92 kPa
Prevent Interference with Pre-existing Dive Equipment	Closest Allowable Distance for Devices Controls from Common Location of Pre-existing Scuba Controls	10 cm
Targets and Metrics Not Directly Related to Functions	Wetsuit Should Be Made Out of Neoprene Material	3 mm (thickness)
	Device Works with Different Body Compositions	Compatible with 90% of all Paraplegic Divers
	Maximum Cost of Device	$700

Function: Ease of Attaching Device

To determine how easy the device is for a paraplegic person to attach, an estimate of how much time each concept will take to attach will be made. To make this time estimation, considerations for the limited mobility of the paraplegic diver must be considered. If the design incorporates a wetsuit, a metric of 8 min was assigned. The 8-min time restraint was decided on after averaging the time it takes for paraplegic divers to put on their own equipment without the addition of the proposed device. If the design does not incorporate a wetsuit, a metric of 3-min was assigned. To validate that the chosen design meets or exceeds this metric, the prototype will be given to a paraplegic diver and the diver will be timed on how long it takes them to attach the device.

Function: Protects Diver Against Abrasions and Stings

To protect against abrasions and stings while under water, divers typically wear exposure suits while diving. If the proposed design incorporates an exposure suit, two targets will have to be met. The first is that the exposure suit is similar in thickness to those commercially available (i.e. 1 mm – 3mm). The second target is that the exposure suit design will expose no more skin than exposure suits commercially available. For this target, the metric that that will be assigned, is there will be no more than 100 cm^2 of additional skin directly exposed to the water than a standard exposer suit. Assuming the additional surface area of the exposed skin will be in the ankle region, the equation that will be used to determine the additional surface area is Equation C-1.

Equation C-1 $$SA = 2\pi rh$$

In Equation C-1 r represents the radius of the ankle and h represents the height of the exposed skin. If no exposure suit is incorporated into the final design, it will be assumed that the diver is wearing some form of exposure suit to protect against abrasions and stings while under water.

Function: Afford Safe Body Temperature

Not only does an exposure suit protect against abrasions and stings it also helps regulate the diver's temperature while underwater. A wetsuit of 3mm can keep a diver from becoming hypothermic in waters as cold as 14.5 °C for 1.5 hours [*Evo*]. It accomplishes this by keeping an insulating layer of warmer water between the diver and the wetsuit. If an exposure suit is incorporated into the final design, it must meet this target. To accomplish this the permeability of the designed suit must be comparable to that of a commercially available product. For this target, the metric will be set such that the designed suit retains 80% as much water as a

commercially available suit would in a set amount of time. The test that is going to be performed to validate this metric is to wear a commercially available suit, pour in a set amount of water, and see how much drains out in a set amount of time. The designed suit will then be worn by the same person, the same amount of water will be poured in and then the amount that drains out in the same amount of time will be measured. If 80% or more water is retained the target has been validated.
