***Plasma Tungsten Arc (PTA)*:** An electric arc is formed between a non-consumable tungsten electrode and the workpiece. The generated plasma is forced through a tooling nozzle toward the workpiece at high velocities and extreme temperatures. PTA is especially limited by the size of the arc. With an increased arc size more heat is transferred to the workpiece. Heat input is noted as a layering of distinct microstructure, more commonly referred to as the heat affected zone (HAZ). As the HAZ increases there is an increase in the dilution layer which requires the addition of more material. Clad geometries and compositions are also affected by the arc size. Materials laid thinner than 3mm are likely to fail due to excessive dilution of the clad with base material while clads greater than 0.25" thick may fail due to instability in the weld.

***High Velocity Oxygen Fuel (HVOF)*:** Fuel and oxygen are mixed and ignited to combust. Utilizing the high pressure formed, the mix is then pushed through a nozzle delivery where it combines with a powder feed stock. The stream of hot gas and powder is then sprayed onto the workpiece surface. Partially melted within the gas stream, the powder then solidifies upon impacting the substrate. This bond is mechanical making the surface preparation of the substrate critical. The HVOF process relies heavily on the kinetic energy of the powder particle. The result is lower dilution and a smaller HAZ in the parent material. Without a full metallurgical bond the layering is significantly vulnerable to chipping, peeling, or cracking. As such any corrosion or inclusions are detrimental as migration can lead to complete failure of the layer. Maximum coating thickness for HVOF is ⅛". HVOF has had the most success with ceramics and the deposition of cermets.

***LAP™*:** The LAP™ process is used to laser clad metal powder alloys to enhance or repair parts in a similar fashion to HVOF and PTA. Like HVOF, the laser melts a pool on the workpiece while powdered metal is fed through a nozzle into the puddle, creating a clad. A full metallurgical bond is achieved by fully melting the surface of the substrate while applying powder. The precisely targeted heat of the laser allows lower penetrations of the parent material and a smaller HAZ is noted. This translates to an enhanced grain structure and lower necessary clad thickness compared to PTA applied clads. Parametric accuracy of the system means that minimum clad layers as thin as 0.004" are attainable, while maximum clad thickness of over 3" have been successfully attained.