Comparison between two Gas-Liquid Flow Impellers: Poseidon (IFP design) and with Phase Velocity Control (PVC)

	Impeller Poseidon – Ip1	**Phase Velocity Control – Ip2** (1)
Main geometrical features	Helico axial – **Strictly** axial Large blade length (Lb1) and large blade curvature radius (Rb1) Meridional hub shape: Concave to reinforce Coriolis force effect (3)	Helico axial - **Slightly** radial with **two concavities at cover** (concave to convex: Inlet to outlet) – (2) Medium blade length (Lb2) and medium blade curv. Radius (Rb2) Meridional hub shape: Determined for optimum SP flow performance
Design & Principle of operation	**Minimum acceleration in a 3D orthogonal system** – Minimum dependent on energy transfer. **TARGET**: To permit flow mixing beyond natural mixing and limit separation force effect	Relaxation in acceleration criteria. **Liquid accelerated from impeller entrance** (use of radial acceleration) **TARGET**: To create phase separation with phase velocity control along cover (fraction of radial acceleration)
Flow behaviour and characteristics	Flow mixing maintained at Low GLVR - GLVR1 limit dependent on GLDR. Beyond GLVR1, phase separation with **Vl significantly smaller than Vg** inducing large interfacial and other losses	Natural flow mixing at Very Low GLVR. Beyond GLVR2 (<GLVR1), phase separation occurs with Vl accelerated from impeller entrance and Vl # Vg from impeller mid axial position to exit
SP and TP losses	Large impeller friction losses Large impeller interfacial losses and entrance losses at diffuser (Different L & G incidence angle)	Less imp. friction losses (Lb2<Lb1) Less impeller interfacial losses and Less entrance losses at diffuser (Same L & G incidence angle)
SP and TP Hydraulic performance	Medium SP Efficiency Medium SP Pressure Coefficient Low TP Efficacy Low TP Efficiency Low TP Pressure Coefficient Medium inlet volume flow (Qin)	Larger SP Efficiency (Lb2<Lb1) Larger SP Pressure Coef. (Rb2<Rb1) Larger TP efficacy Medium to large TP Efficiency Medium to large TP Pressure Coef. Larger Qin (larger inlet blade angle)
For a better performance	To control secondary flow within impeller (Flow mixing): Difficult !	To initiate phase velocity control right from impeller entrance: New diffuser

Abbreviations – L: Liquid, G: Gas, Lb: Blade Length, Rb: Blade Curvature Radius, GLVR: Gas Liquid Volume Ratio, GLDR: Gas Liquid Density Ratio, Vl: Liquid velocity, Vg: Gas velocity, SP: Single Phase, TP: Two Phase.

Note 1: See drawing 8 of patent; ***Note 2***: **A helico axial impeller including a radial cover with a single concavity cannot provide satisfactory performance** as the liquid phase is continuously accelerated (Vl<Vg in 1st impeller section and Vl>Vg in 2nd section) therefore **Vl=Vg is met only at a single point** (large interfacial losses outside that point). ***Note 3***: See page 11 of patent document