Variable	Description	Lower Bound	Nominal Value	Upper Bound	Units	Type	Comments/Notes
gamma	AUVs serviced per mission (e.g. 5 per day if mission length is 1 day)	1	2	10	[AUVs/mission]	Design Variable	
D_f	Platform float diameter	0.1	2	10	[m]	Design Variable	
t_f	thickness of top float	0.01	0.5	3	[m]	Design Variable	
t_s	length of middle support spar	1	2	50	[m]	Design Variable	
D_s	diameter of middle support spar	0.1	1	10	[m]	Design Variable	
t_d	thickness of bottom dampening plate	0.01	0.5	3	[m]	Design Variable	
D_d	diameter of bottom dampening plate	0.1	1.25	10	[m]	Design Variable	
GM	metacentric height stability	≥ 0			[m]	Constraint	
Fb	buoyant force must offset weight of platform in water	= Fg			[N]	Constraint	
	hydrodynamic stability - **How to formulate this mathematically?**					Constraint	
E_recharge	energy harvested by PEARL must be greater than the energy needs of PEARL	≥ E_hotel + E_service + E_comms + E_move			[Ws]	Constraint	
OPEX	Operating cost, $/AUV mission hour				[$/hour]	Objective	
z_B	center of buoyancy	= (h_f + t_s + t_d)/2			[m]	Dependent Variable	
z_G	center of gravity				[m]	Dependent Variable	
A_solar	solar panel area				[m^2]	Dependent Variable	
P_recharge	power harvested from solar energy to recharge PEARL				[W]	Dependent Variable	
V_PEARL	velocity of platform when moving				[m/s]	Dependent Variable	
S_w	wetted surface				[m^2]	Dependent Variable	
I_wp	second moment of area of the water plane area				[m^4]	Dependent Variable	
A_33	heave added mass				[kg]	Dependent Variable	
B_33	heave damping coefficient				[kg/s]	Dependent Variable	
C_33	hydrostatic restoring coefficient				[kg/s^2]	Dependent Variable	
omega_0	heave resonant frequency				[rad/s]	Dependent Variable	
A_11	surge added mass				[kg]	Dependent Variable	
A_15	coupled surge-pitch added mass (same as A_51)				[kg*m]	Dependent Variable	
I_15	body-inertial coefficient of coupled surge-pitch (same as I_51)				[kg*m]	Dependent Variable	
B_11	surge damping coefficient				[kg/s]	Dependent Variable	
B_15	coupled surge-pitch damping coefficient (same as B_51)				[N*s]	Dependent Variable	
I_55	moment of inertial about the still water line				[kg*m^2]	Dependent Variable	
A_55	pitch added mass				[kg*m^2]	Dependent Variable	
B_55	pitch damping coefficient				[kg*m^2/s]	Dependent Variable	
C_55	restoring moment in pitch				[N*m]	Dependent Variable	
xi_5	pitch angle				[rad]	Dependent Variable	
G_r	receiver antenna gain (function of G_nr and xi_5)				[dB]	Dependent Variable	
R	data rate				[Mbps]	Dependent Variable	
P_comms	power required to transmit data per mission				[W]	Dependent Variable	
m_batteries	mass of batteries				[kg]	Dependent Variable	
m_solar	mass of solar panels				[kg]	Dependent Variable	
m_structure	mass of structure				[kg]	Dependent Variable	
m_platform	total mass of the platform				[kg]	Dependent Variable	
E_battery	power storage capacity of the battery onboard the platform				[Ws]	Dependent Variable	
D	total amount of data PEARL can transmit to a satellite				[Mb]	Dependent Variable	
C_storage	amount of data storage required on board PEARL				[Mb]	Dependent Variable	
omega	incident wave frequency				[rad/s]	Parameter	
A	incident wave amplitude				[m]		
P_hotel	Hotel load from all sensors on PEARL	50			[W]	Parameter	
eta_s	solar cell efficiency	27%			[%]	Parameter	
phi_s	incident solar irradiation, determined by location	800			[W/m^2]	Parameter	
theta_bar	average solar angle from the vertical over the day. Nominal is fixed, flat solar panel. It changes if the solar panel is slanted (requires orientation control) or gimbaled (requires solar array drive)	55			[deg]	Parameter	
I_deg	Inherent degradation, an efficiency parameter that describes the fraction of solar panel area that is actually solar cells, taken to be between 0.85-0.9	0.9				Parameter	
d_deg	solar cell degradation, nominally set to 0.5%/year, ranging from 0.1-2%/year, depending on solar cell material	0.50%			[%/year]	Parameter	
L_solar	lifetime of solar panels	10			[years]	Parameter	
t_recharge	time the platform is recharging, nominally taken to be the number of daylight hours	12			[hours]	Parameter	

E_AUV	AUV battery capacity, selected from Bluefin-9	1900	[Wh]	Parameter	
t_service	duration of time that AUV is connected to platform recharging and offloading data (time that platform is in "service" mode)	12	[hours]	Parameter	Should this be >=X? Given that each AUV takes X hours to charge? Or related to # of AUVs charged per day and charging time?
t_mission	total duration of the mission of the platform	24	[hours]	Parameter	
t_comms	total time data is transmitting data per mission	4	[hours]	Parameter	
t_move	total time the platform is moving per mission (assume 5% of t_mission for now)	1.2	[hours]	Parameter	
rho	density of seawater	1023	[kg/m^3]	Parameter	
C_d	drag coefficient of PEARL	1		Parameter	estimated for now
eta_m	propulsion efficiency	75%		Parameter	
m_comms	mass of communication system	50	[kg]	Parameter	
m_propulsion	mass of the propulsion system on the platform	50	[kg]	Parameter	
mu_battery	battery specific energy density, taken to be for Li-ion for now	200	[Wh/kg]	Parameter	
nu_battery	battery volumetric energy density		[Wh/L volume]	Parameter	
DOD	the depth of discharge of the battery, nominally taken to be 70% and can range from 50-90%. DOD depends on the lifetime of the battery and battery type selected, which affects the battery specific volume, mass, and cost.	70%		Parameter	
eta_battery	transmission efficiency between the battery and the load	85%		Parameter	
N	number of batteries	1		Parameter	
L_l	transmitter to antenna line loss		[dB]	Parameter	set by terminal, check Iridium
L_s	space loss		[dB]	Parameter	set by terminal, check Iridium
L_a	transmission path loss		[dB]	Parameter	set by terminal, check Iridium
G_nr	nominal receiver antenna gain		[dB]	Parameter	set by terminal, check Iridium
k	Boltzmann constant	1.38065E-23	[J/K]	Parameter	
T_s	system noise temperature		[dBK]	Parameter	
R	data rate	50	[Mbps]	Parameter	
E_b	energy per bit		[Ws]	Parameter	set by terminal, check Iridium
N_o	noise spectral density		[W/Hz]	Parameter	set by terminal, check Iridium
T_max	maximum time the satellite would be in view		[s]	Parameter	
T_initiate	time required to initiate a communication pass		[s]	Parameter	
M	margin used to account for missed passes			Parameter	
F	fractional reduction in viewing time due to a satellite passing at an angle away from the ground (not directly overhead)			Parameter	
D_AUV	data to be transmitted per AUV		[Mb]	Parameter	

Inputs	gamma, geometry	geometry	geometry		gamma, geometry, R	
	Power Harvesting	P_recharge	m_batteries	P_recharge	m_batteries	
		Propulsion Module	V_PEARL			
Structural response			**Hydrodynamics Module**	Structural response		
				Satellite Communications	R, C_storage	
					System Cost	OPEX
						Output (Obj.)