

DWT 13K 급 Product/Chemical Tanker

선형 개발

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유체설계팀

선박
해양플랜트
연구소



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KOREA RESEARCH INSTITUTE OF SHIPS & OCEAN ENGINEERING

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선박
해양플랫폼
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Speed-Power Prediction

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1. Speed-Power Prediction

- Speed Power Prediction

ITEM		Unit	2021 13K Tanker 표준선	REMARKS
LBP/B/Td		m	120.0 / 21.0 / 8.7	
L/B		-	5.714	
B/Td		-	2.414	
Cb at Td		-	0.780	
WSA		m ²	4000.0	
SBK		m ²	40.8	
Propeller type		-	FPP	
Cr x 1,000	@ 13.0kts (Fn=0.192)	-	0.893	모형 시험 결과
PE		kW	1,692	Ca = 0.00016
ETAD		-	0.707	모형 시험 결과
PB		kW	2,418	
Prop. Dia. X NOB		m x -	4.5 x 4	
Speed at NCR w/ 15% S.M		knots	13.00	

1. Speed-Power Prediction

- 개발 계획

ITEM	Unit	비교 대상선 MT	비교대상선 CFD	2021 표준선 MT	2021 표준선 CFD	2023 표준선 CFD	REMARK
LBP/B/Td	m	120.4/20.4/8.7		120.0 / 21.0 / 8.7		122.0* / 21.0 / 8.55	Mid 2m 증가
L/B	-	5.902		5.714		5.809	
B/Td	-	2.345		2.414		2.456	
Cb at Td	-	0.796		0.780		0.7819	
LCB	%	0.72		0.89	0.92	0.95 ~ 0.99*	*요청 사항
WSA	m ²	3958.9		4000.0	3938.74	-	
SBK	m ²	33.1		40.8			
Propeller type	-	FPP				CPP	
Cr x 1,000	@ 13.0kts (Fn=0.192)	-	1.169	1.150	0.893	0.832	
PE		kW	1,870	1,857	1,692	1,631	
ETAD		-	0.634		0.707		
PB		kW	2,979	2,958	2,418	2,401	2,970* * 요청 사항

* #40(2.1m) ~ #80(110.88m) 유지 (Cargo Volume 확보)

1. Speed-Power Prediction

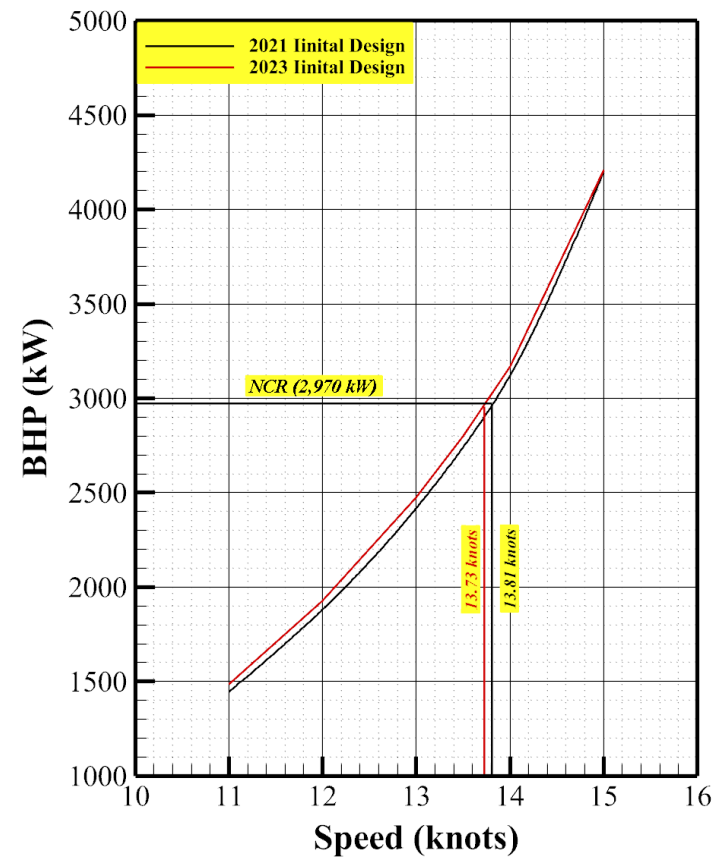
- Power Prediction (Powering)

ITEM		Unit	2021 표준선	2023 표준선	REMARK
LBP/B/Td		m	120.0 / 21.0 / 8.7	122.0 / 21.0 / 8.55	
L/B		-	5.714	5.809	
B/Td		-	2.414	2.456	
Cb at Td		-	0.780	0.7819	
LCB		%	0.89	0.99	
WSA		m ²	4000.0	3970.13	
SBK		m ²	40.8		
Propeller type		-	FPP	CPP	
Cr x 1,000	@ 13.0kts (Fn = 0.1906)	-	0.886	0.882	
PE		kW	1,647	1,696	
ETAD		-	0.707		
ETAT		-	0.99	0.97	
PB		kW	2,353	2,473	

1. Speed-Power Prediction

- Speed - Power Prediction (Trial)

	BHP (kW)	
Speed (knots)	2021 표준선	2023 표준선
11.0	1,445	1,484
12.0	1,881	1,928
13.0	2,418	2,473
13.5	2,740	2,797
14.0	3,119	3,170
15.0	4,196	4,209



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Hull Form Design

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2. Hull Form Design



❖ Performance Evaluation by CFD(STAR-CCM+)

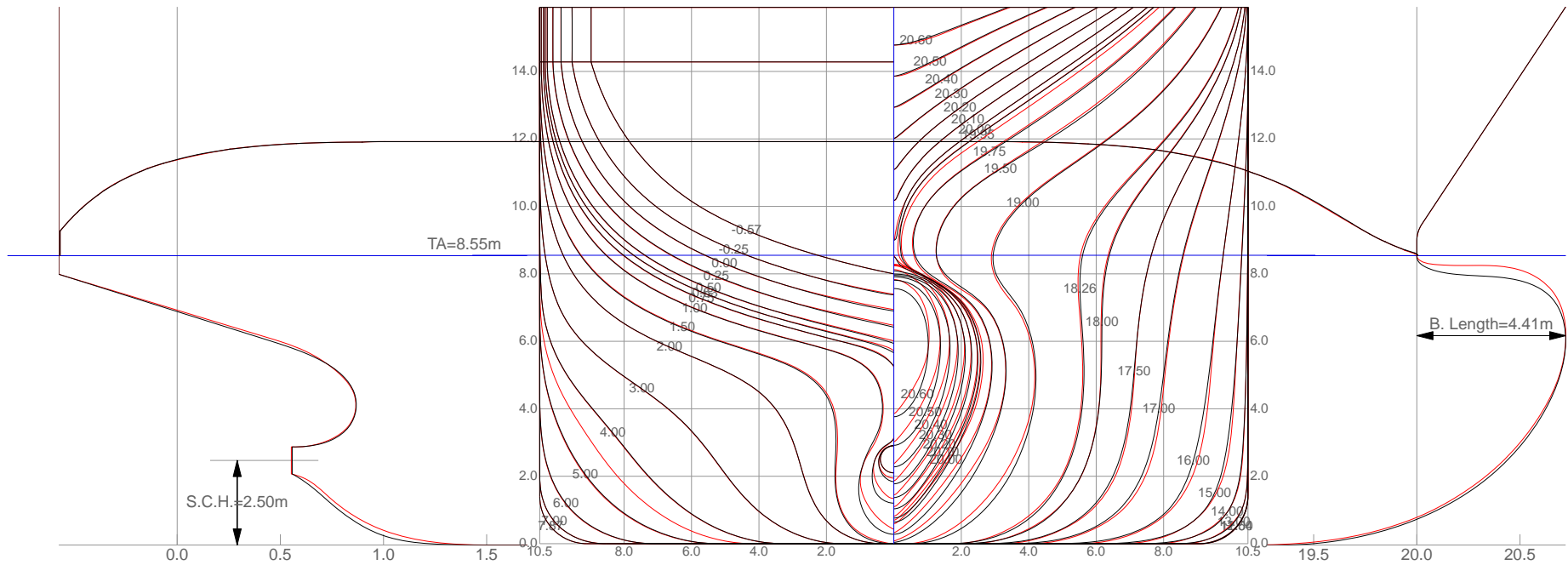
▪ STAR-CCM+ Set-up for Calculation

Solver	STAR-CCM+ ver.11.06
Geometry	Hull + Appendage
	Model Scale : 26.8
Material	Temperature : 15.0°C
Mesh Model	Prism Layer Mesher
	Surface Remesher
	Trimmer
Physics Model	Time : Implicit Unsteady
	Time step : 0.025s(1st order)/Inner iteration : 5
	Solution time : 80.0s
	Governing Equation : RANS Equation
	Turbulence model : Reynolds Stress Turbulence (Linear Pressure Strain)
	Volume of Fluid(VOF)
Calculation Condition	w/ Free Surface
	w/ motion(free, Equilibrium)

2. Hull Form Design

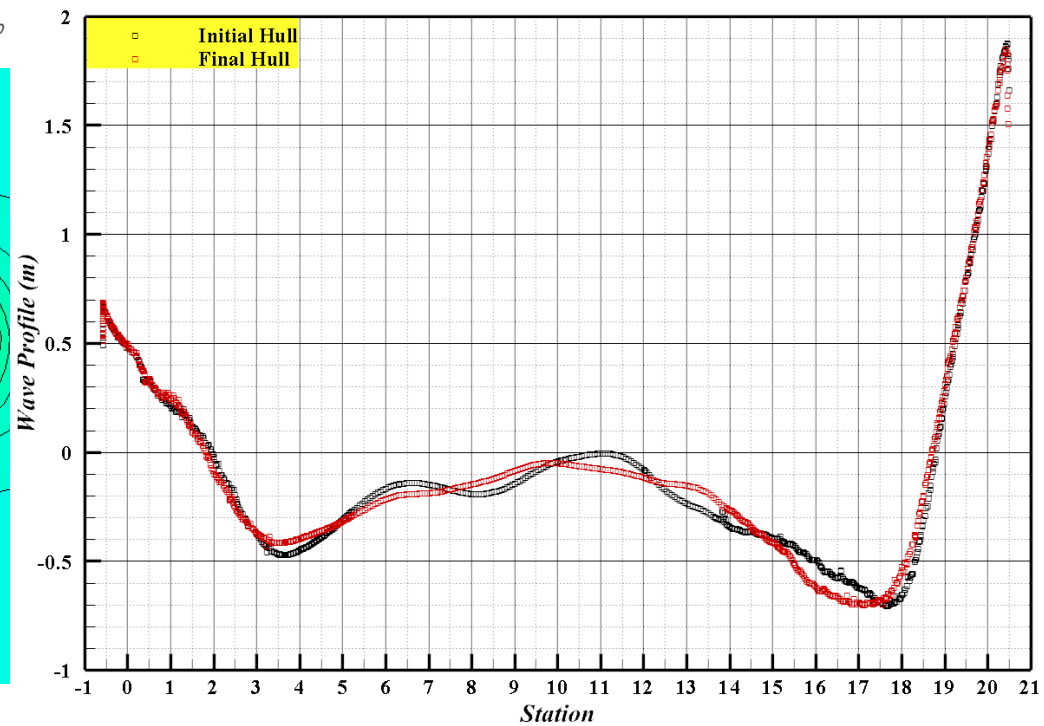
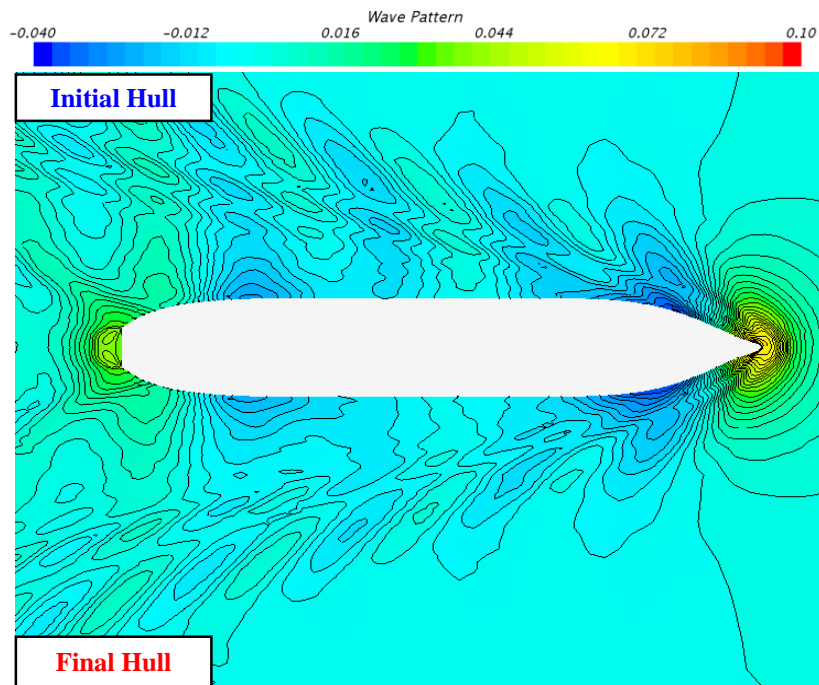
❖ Profile

Ship name	LineType	LBP	Breadth	Draft	L/B	B/T	CB	LCB(%)	Fn	LWL	Vol	WSA	KMT
Initial Design		122.00	21.00	8.55	5.810	2.456	0.782	0.998	0.201	125.50	17,130	3,972	8.900
Final Design		122.00	21.00	8.55	5.810	2.456	0.782	0.985	0.201	125.50	17,127	3,971	8.818



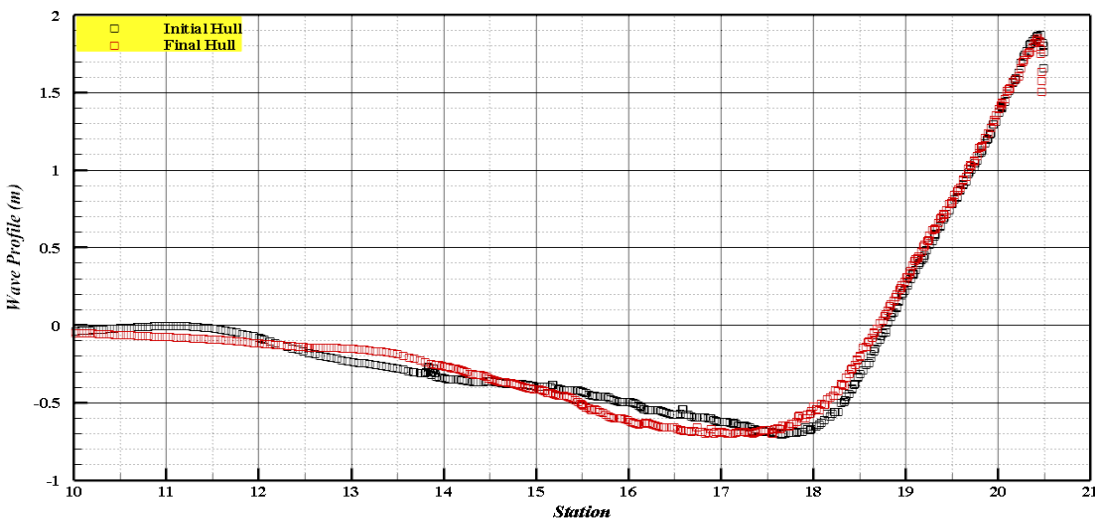
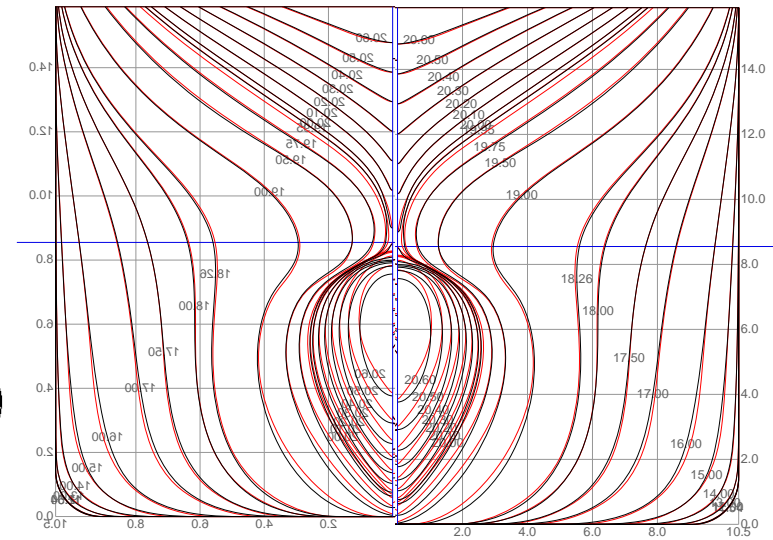
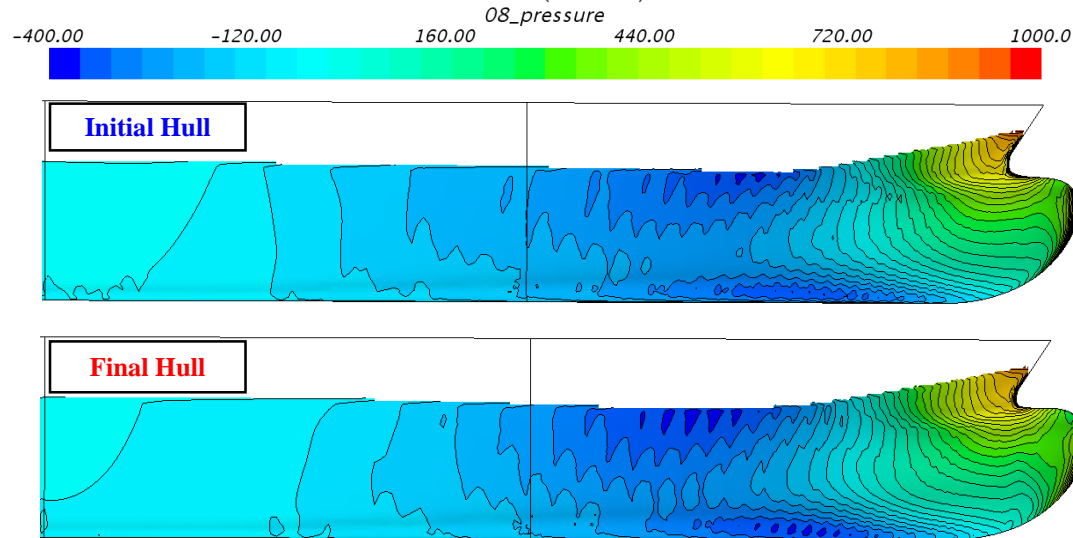
2. Hull Form Design

■ Wave Pattern & Wave Profile



2. Hull Form Design

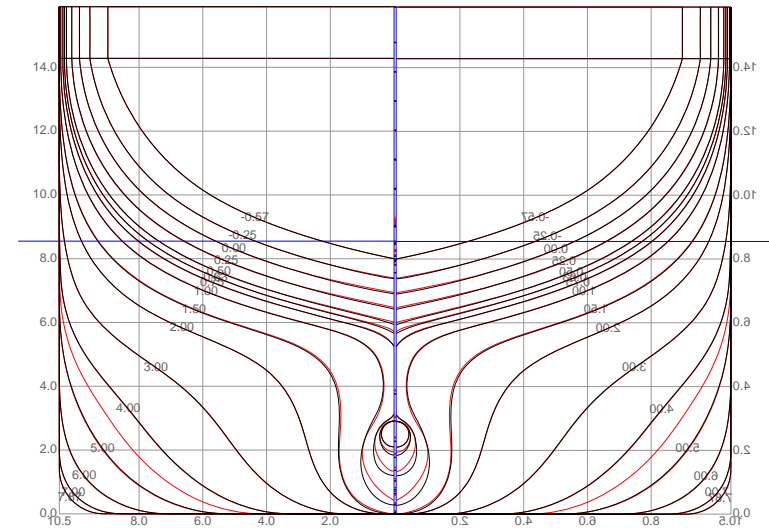
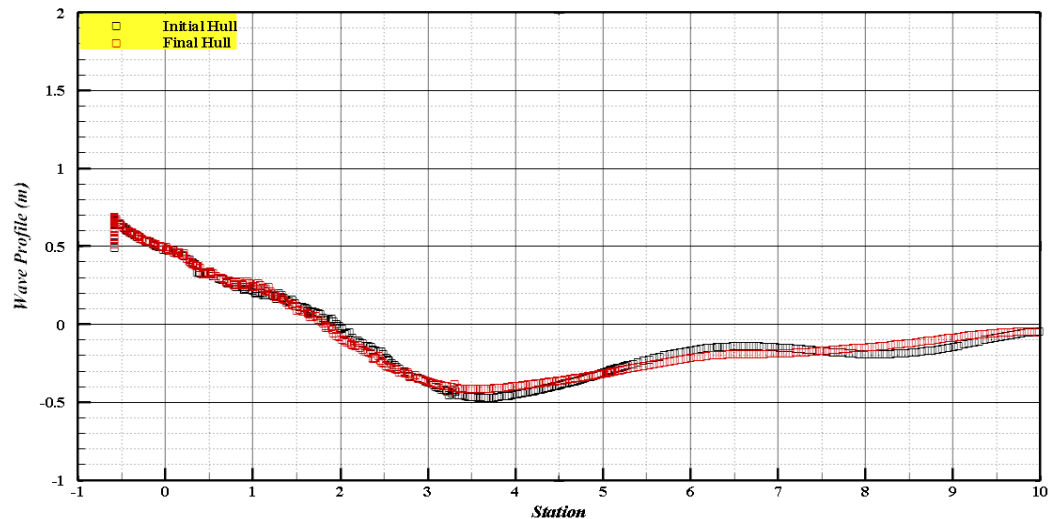
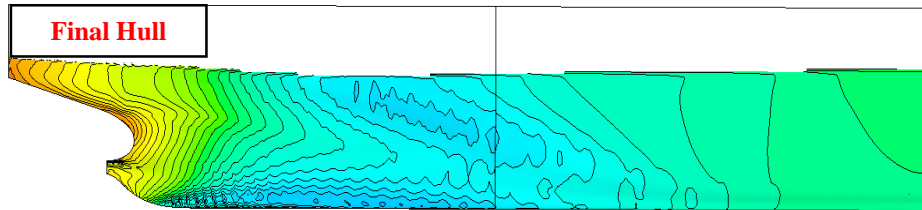
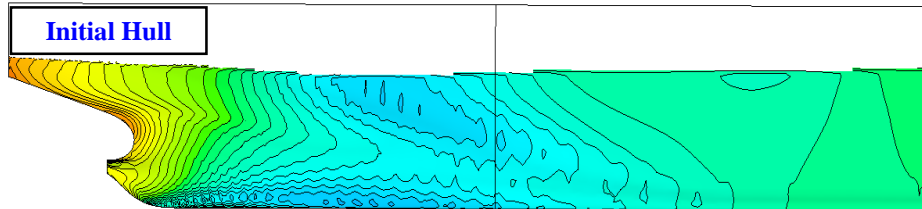
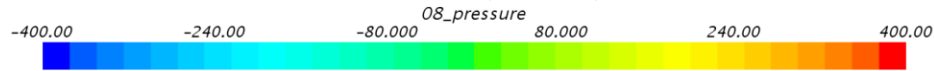
❖ Pressure Distribution (Fore)



	Vs (knots)	Volume (m ³)	WSA (m ²)	CR	PE
Initial Design	13.0	17130.0	3938.7	0.780	1626
Final Design		17126.0	3970.7	0.781	1611

2. Hull Form Design

❖ Pressure Distribution (After)

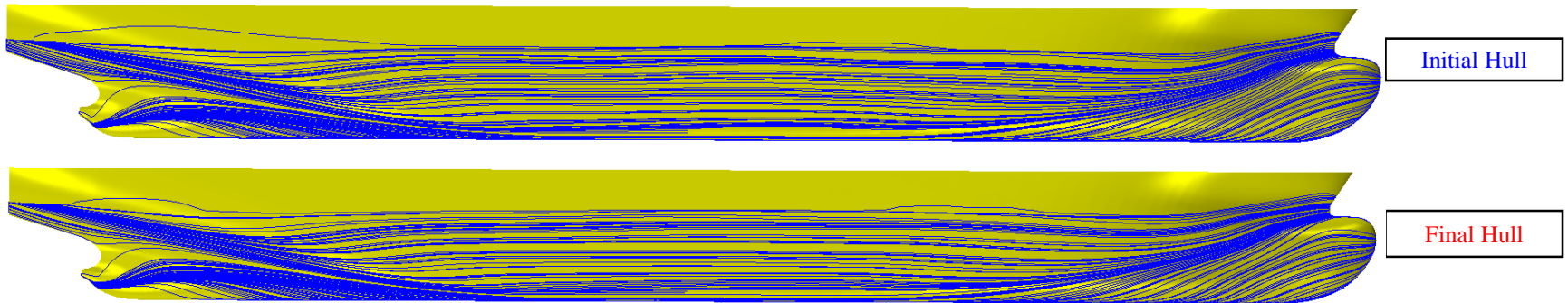


	Vs (knots)	Volume (m ³)	WSA (m ²)	CR	PE
Initial Design	13.0	17130.0	3938.7	0.780	1626
Final Design		17126.0	3970.7	0.781	1611

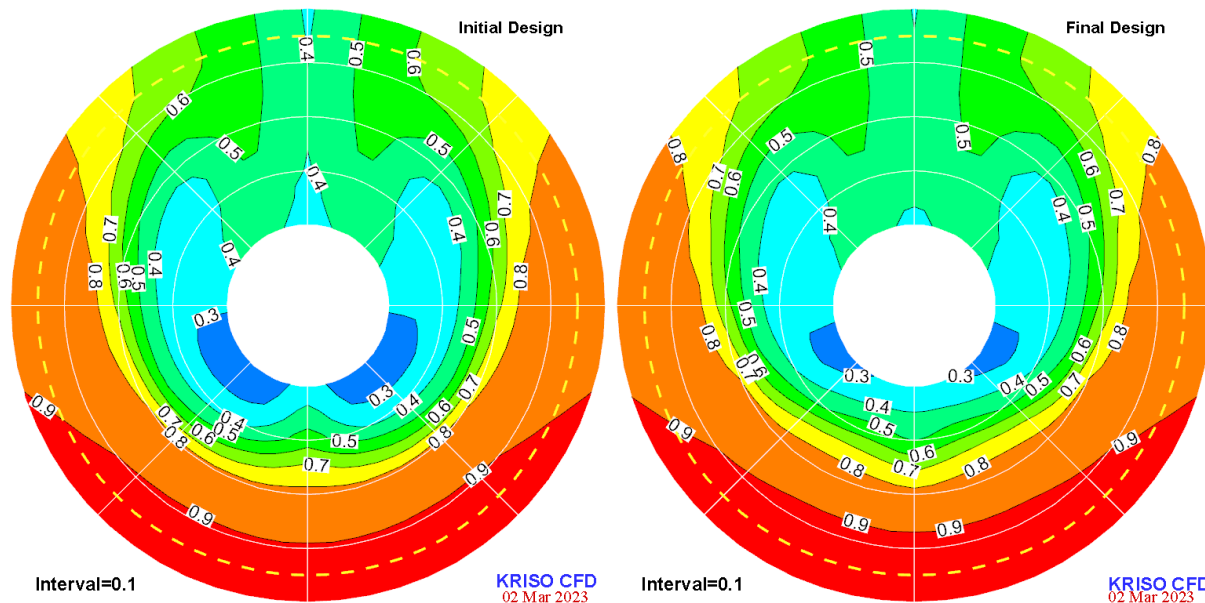
2. Hull Form Design

❖ Performance Evaluation by CFD (STAR-CCM+)

▪ Streamline



▪ Wake Distribution



3 Summary



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3. Summary

❖ Speed-Power Prediction

ITEM		Unit	Initial Hull Form	Final Hull Form	Remarks
LBP/B/Td		m	172.0 / 21.0 / 8.55		
L/B		-	5.809		
B/Td		-	2.456		
Cb at Td		-	0.7820	0.7818	
LCB(%, +fwd)		%	1.0	0.98	
WSA		m2	3971.7	3970.74	
Cr x 1,000	@ 13.0kts (Fn=0.1906)	-	0.806	0.781	
PE		kW	1,626	1,611	-0.94% ↓
ETAD		-	0.707		
ETAT		-	0.99*		* FPP 기준
PB		kW	2,323	2,302	
Prop. Dia. X NOB		m x -	4.8 x 4		
Remarks		-	✓ 자항값(ETAH, ETAR, ETAO)은 사업단이 보유한 유사선을 이용하여 추정 ✓ Ca = 0.00016		



4

FPP & CPP

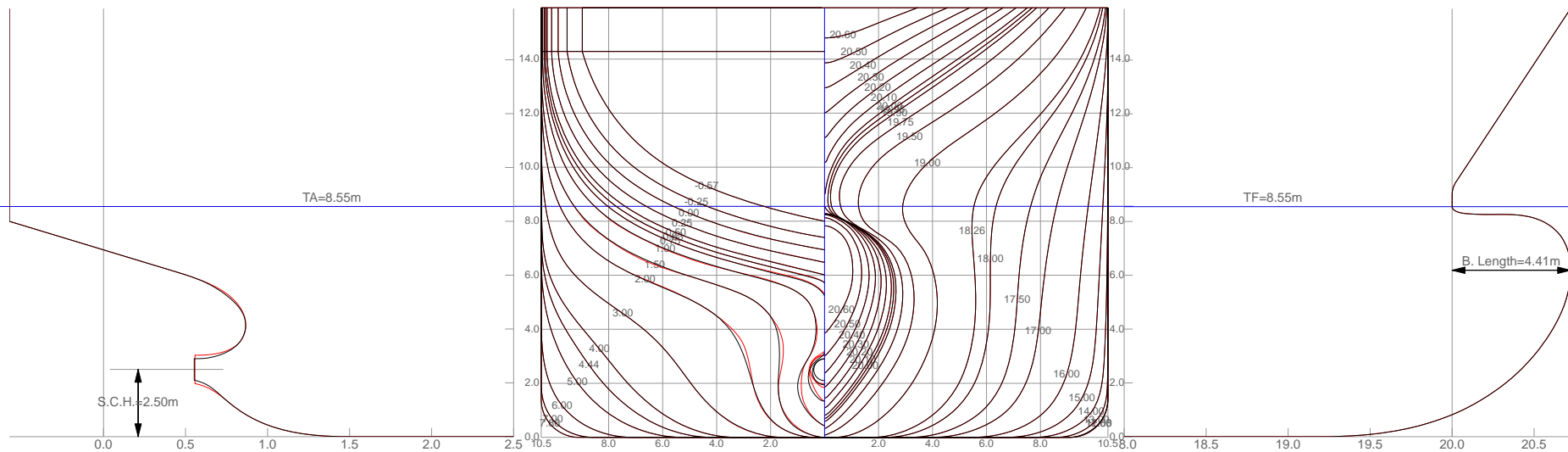


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4. FPP & CPP

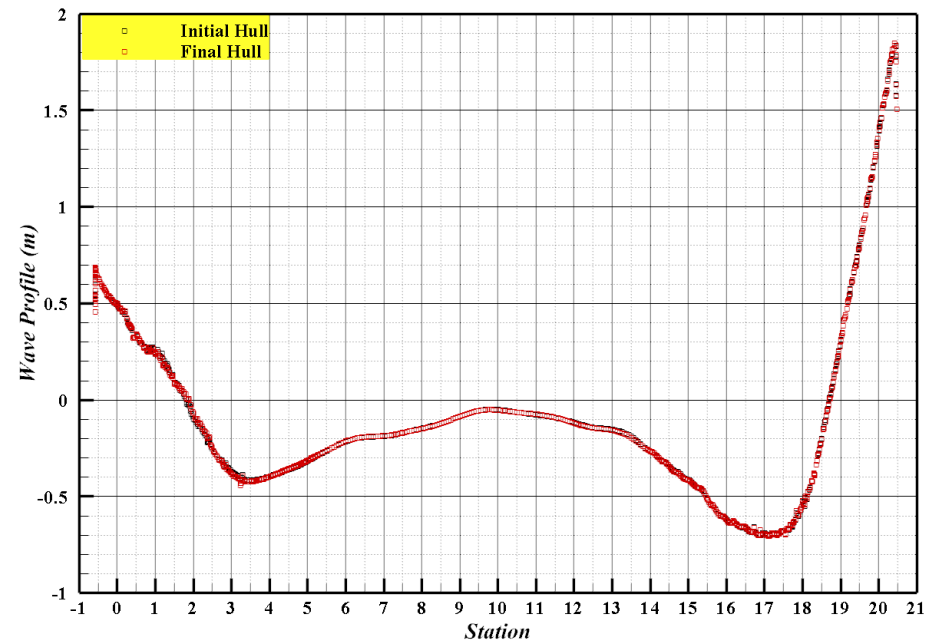
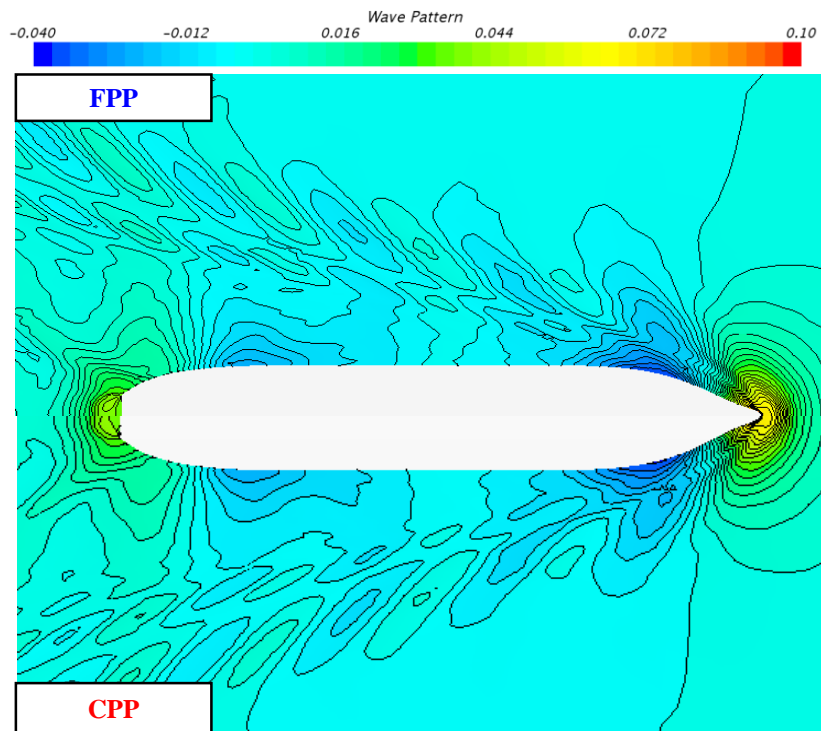
❖ Profile

Ship name	LineType	LBP	Breadth	Draft	L/B	B/T	CB	LCB(%)	Fn	LWL	Vol	WSA	KMT
Final Design		122.00	21.00	8.55	5.810	2.456	0.782	0.985	0.201	125.50	17,127	3,971	8.900
F01A02		122.00	21.00	8.55	5.810	2.456	0.782	0.993	0.201	125.50	17,124	3,972	8.901



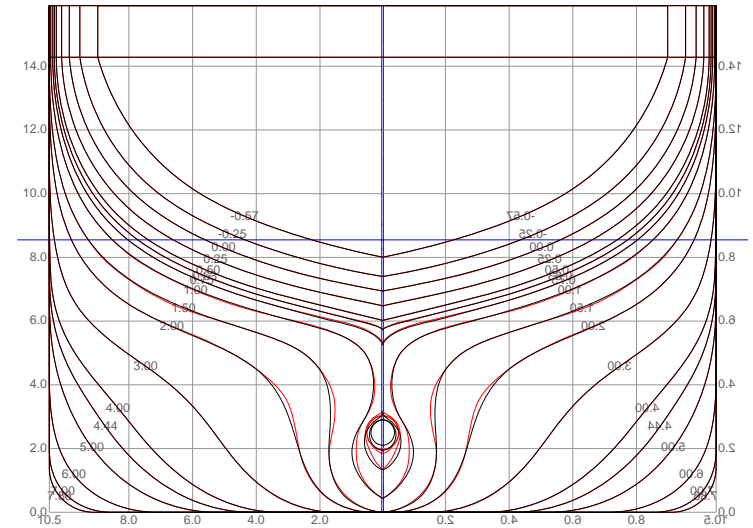
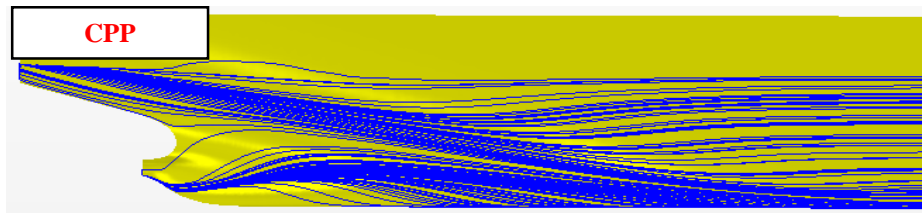
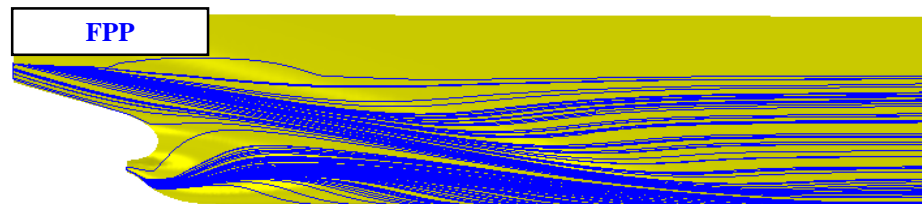
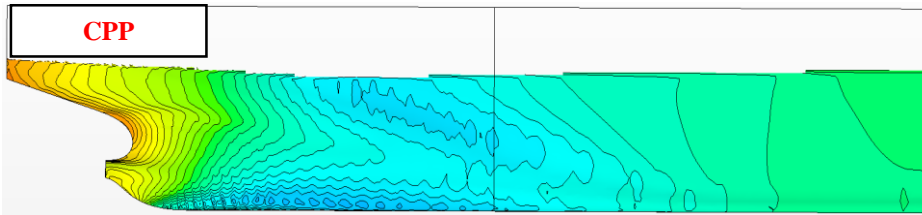
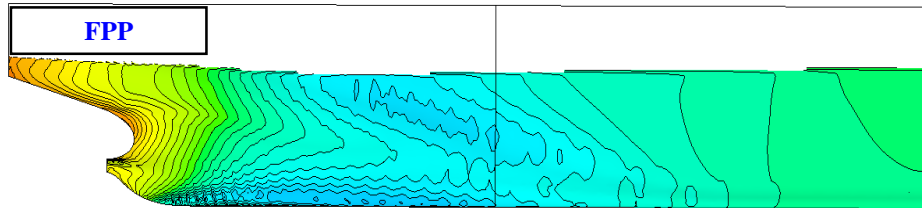
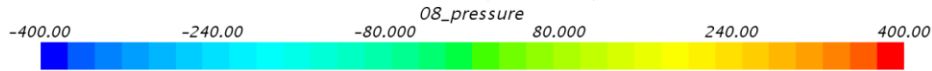
4. FPP & CPP

■ Wave Pattern & Wave Profile



4. FPP & CPP

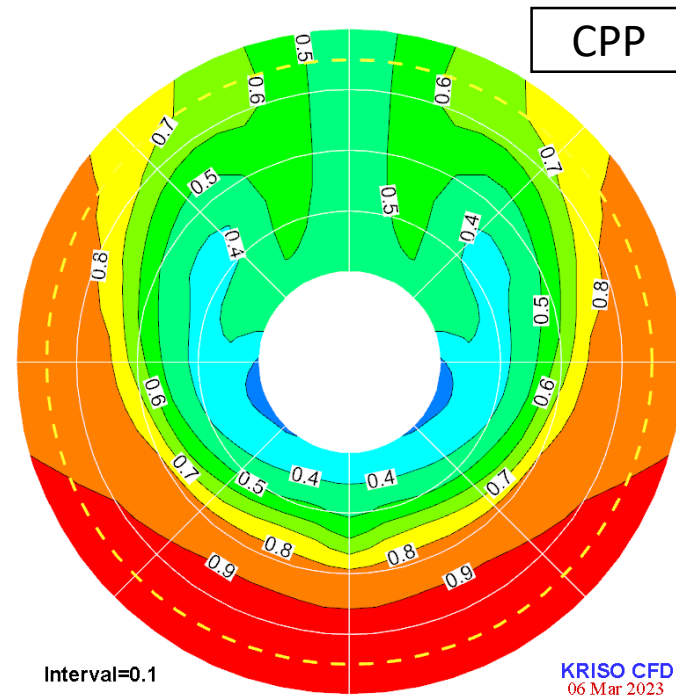
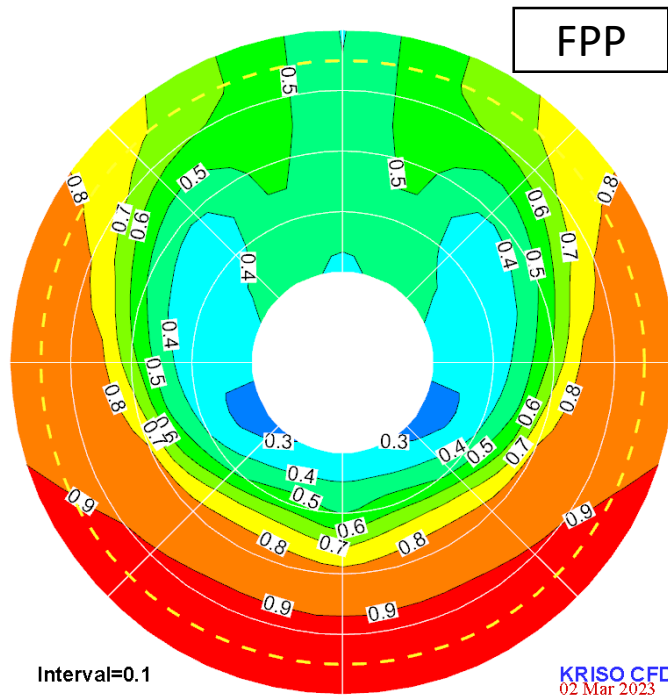
❖ Pressure Distribution (After)



	Vs (knots)	Volume (m ³)	WSA (m ²)	CR	PE
FPP	13.0	17126.0	3970.7	0.781	1611
CPP		17124.0	3971.6	0.781	1613

4. FPP & CPP

Wake Distribution



4. FPP & CPP

❖ Speed-Power Prediction

ITEM		Unit	FPP	Final Hull Form	Remarks
LBP/B/Td		m	172.0 / 21.0 / 8.55		
L/B		-	5.809		
B/Td		-	2.456		
Cb at Td		-	0.7818	0.7818	
LCB(%, +fwd)		%	0.98	0.985	
WSA		m2	3970.74	3970.62	
Cr x 1,000	@ 13.0kts (Fn=0.1906)	-	0.7818	0.7817	
PE		kW	1,611	1,613	-0.94% ↓
ETAD		-	0.707		
ETAT		-	0.99	0.97*	CPP 적용
PB		kW	2,277	2,352	3.3% ↑
Prop. Dia. X NOB		m x -	4.8 x 4		
Remarks		-	✓ 자항값(ETAH, ETAR, ETAO)은 사업단이 보유한 유사선을 이용하여 추정 ✓ Ca = 0.00016		