

Docking Reliability of the *LARS* for *Single-Body Jason*

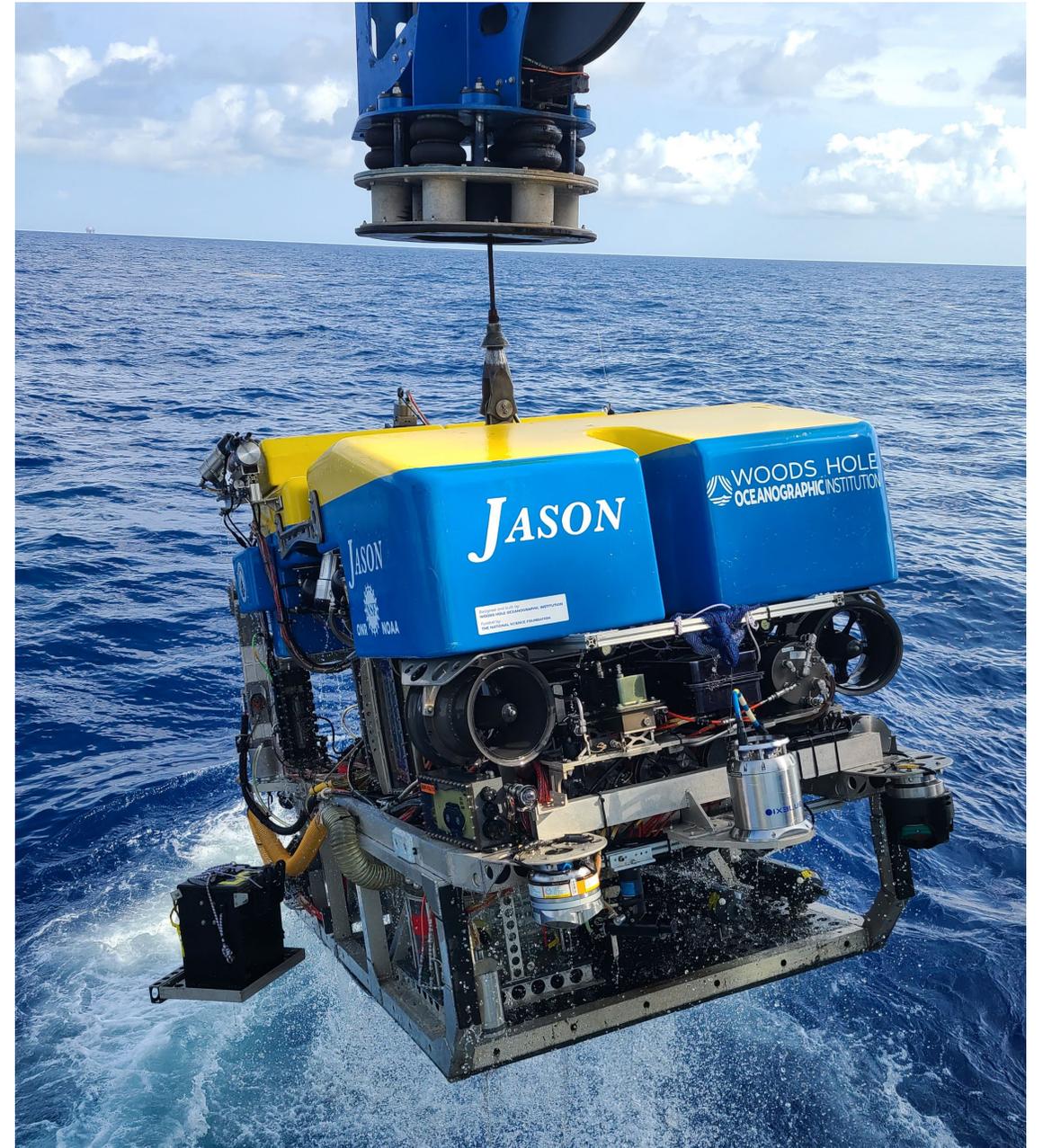
Presented at RVTEC 2021 on October 28, 2021

By Fred Denton

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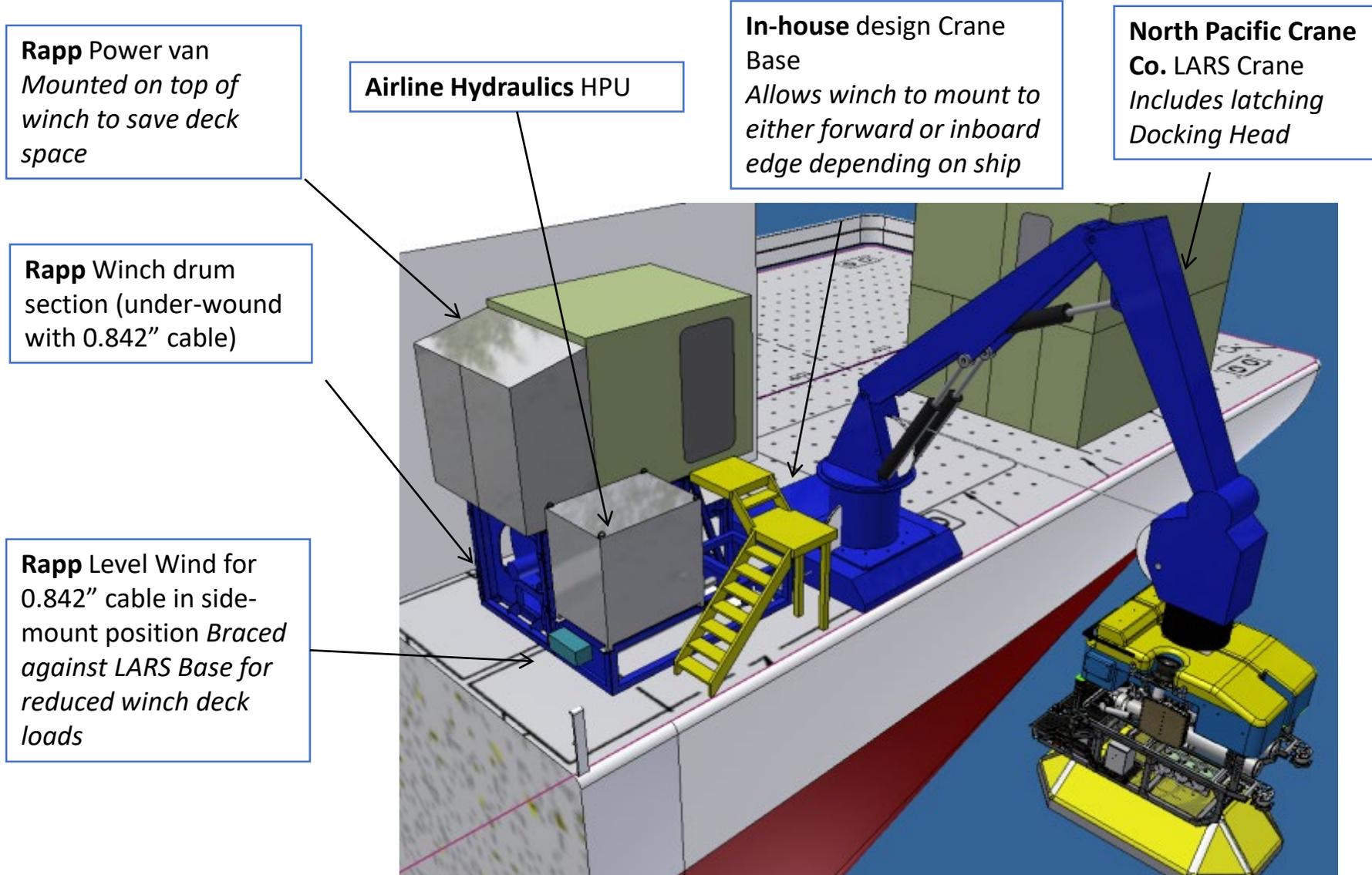
Woods Hole Oceanographic Institution



Launch And Recovery System (LARS) for Single Body Jason



Single-Body LARS: Thompson / Revelle / Brown Layout



Single-Body Jason LARS: Features & Specs

LARS Crane

- 20 ft Reach in Sea State 4 (OOI-RCA Package Deployment)
- 15,000 lb capacity: ROV + <4000 lb. packages
- Latching Docking Head with powered sheave to prevent cable slack in sheave train
- Ships knuckled as one piece with Base

Winch

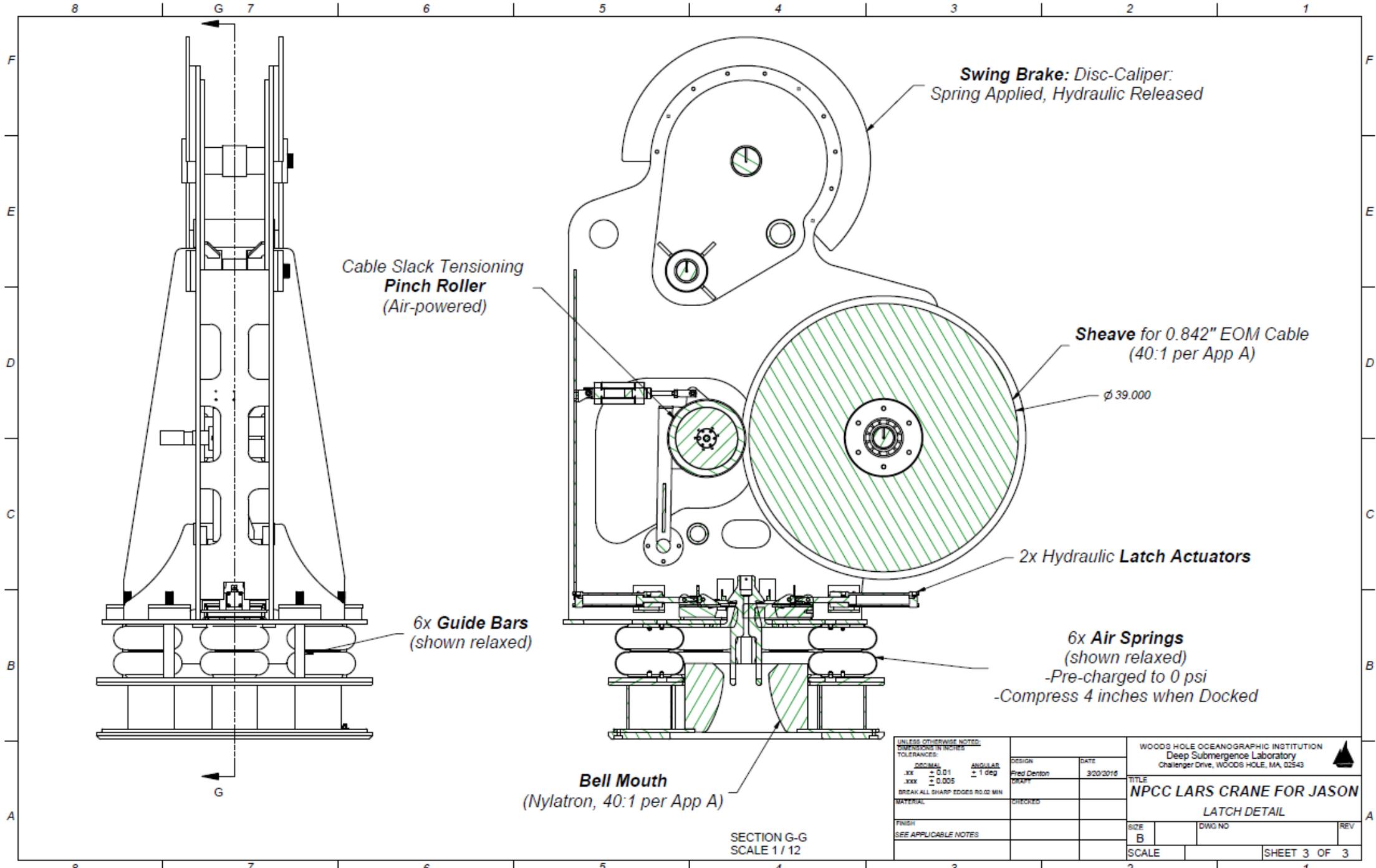
- Carries 5200 m of 0.842" cable
- Active Heave Compensation reduces motion during deployment
- Constant Tension mode for LAR Docking

How Docking Works: in a Recovery Sequence

- 1. Winch:** Haul in to bring Jason up to DH until air springs compressed.
Max winch torque setting (full drum) will stop the winch at 16,000 lb (for 10,500 to 15,000 lb Jason air weight)
- 2. Crane:** Engage DH hydraulic latches
- 3. Winch:** Pay out to lower Jason bullet onto DH latches.
- 4. 3 Operator Checks to confirm latch:**
 1. Latch Light On
 2. Slack cable catenary
 3. "Latch visually confirmed"
Call from control van. IP deck camera in DH
- 5. Winch:** Engage "Constant Tension" mode *~2000 lb setting to take up slack*
- 6. Crane:** Release DH swing brake
- 7. Crane:** Knuckle in and slew around to deck position for Jason
- 8. Crane:** Set DH swing brake
- 9. Winch:** Disengage "Constant Tension" mode
- 10. Winch:** Haul in to re-compress DH air springs
- 11.** Operator Check that winch control reads 16,000 lb
- 12. Crane:** Retract Latches
- 13. Winch:** Pay out to lower Jason down to deck.

Elements for Safe, Secure Docking

- **Winch Torque limit** Set to 16,000 lb - a max value that prevents two-block damage when Jason is docked at reasonable approach speed.
- **Air springs** Provide 4 inches of compliant travel to allow winch to decelerate as torque limiting kicks in.
- **Latch Indicators** 3 redundant indicators that the Latch is holding the load.
- **Transferring most of load to a Latch** Gives winch in tension control mode overhead (above and below) for lagging the crane to avoid slack tension and excess tension
- **A Secure Latch** Geometry & Counterbalance valve keep Latch closed



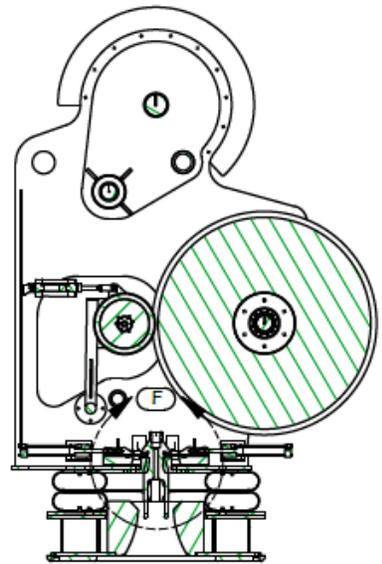
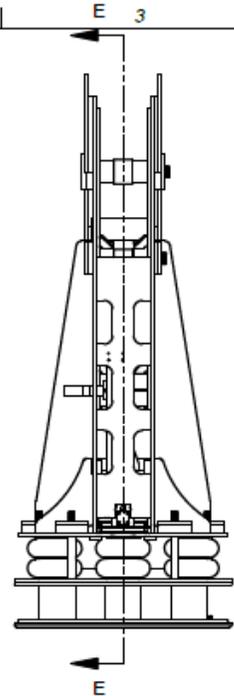
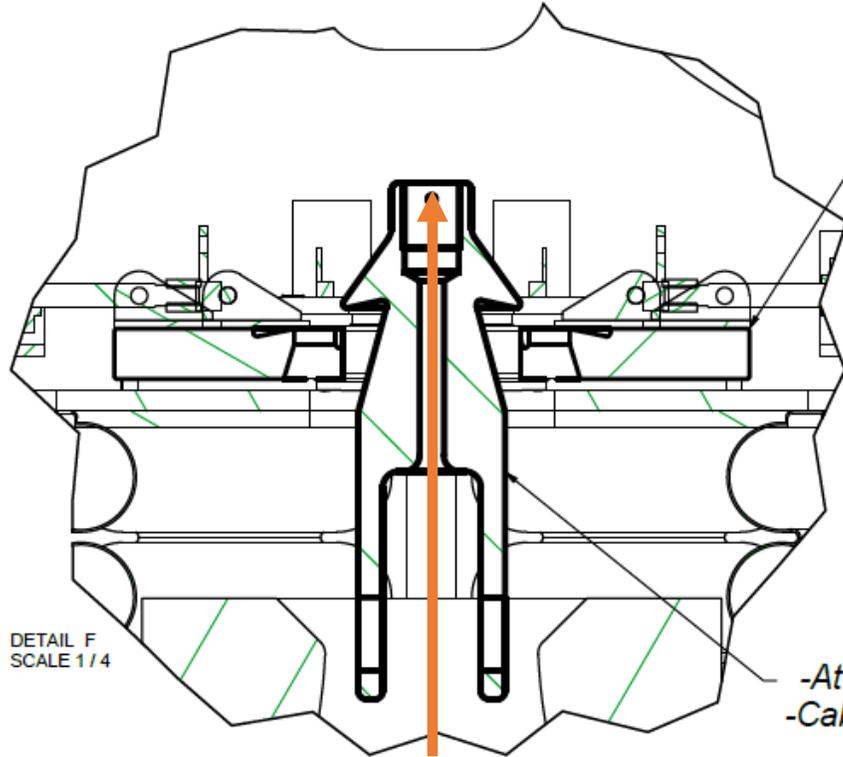
UNLESS OTHERWISE NOTED: DIMENSIONS IN INCHES		DESIGN	DATE
TOLERANCES:		Fred Denton	3/20/2015
DECIMAL	ANGULAR	DRYPT	
.XX ± 0.01	± 1 deg		
.XXX ± 0.005			
BREAK ALL SHARP EDGES R0.02 MIN			
MATERIAL:		SIZES	
FINISH:			
SEE APPLICABLE NOTES			

WOODS HOLE OCEANOGRAPHIC INSTITUTION Deep Submergence Laboratory Challenger Drive, WOODS HOLE, MA, 02543		
TITLE NPCC LARS CRANE FOR JASON		
LATCH DETAIL		
SIZE B	DWG NO	REV
SCALE	SHEET 3 OF 3	

8 7 6 5 4 3 2 1

F
E
D
C
B
A

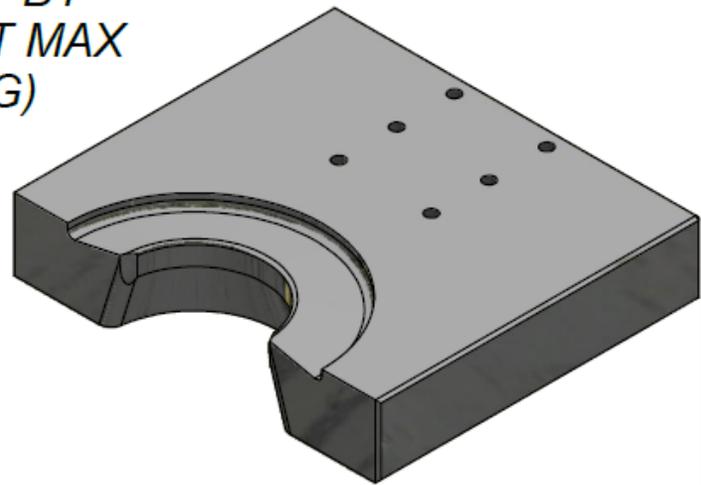
F
E
D
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B
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Docking Bullet
 -At top of Jason on a 2-axis pivot
 -Cable Termination screws into top

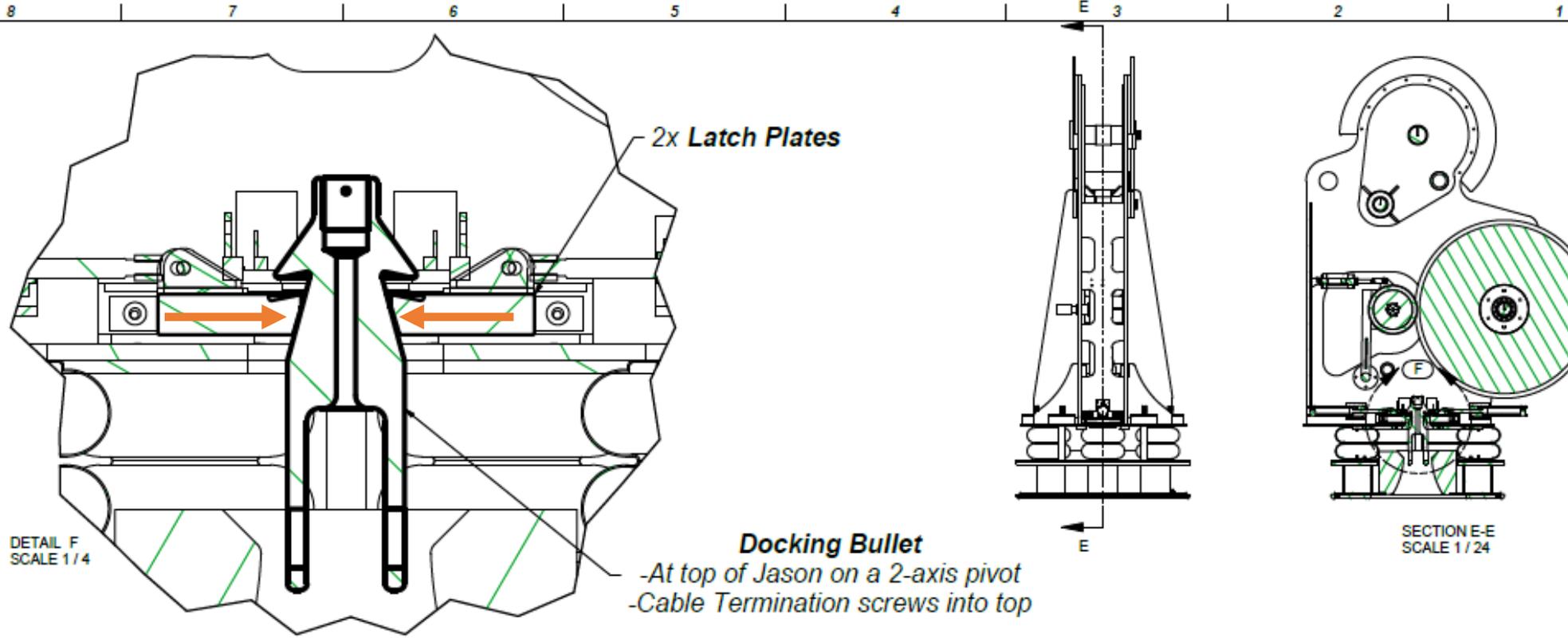
1

**BULLET PULLED UP BY
 WINCH (STOPPING AT MAX
 TORQUE SETTING)**



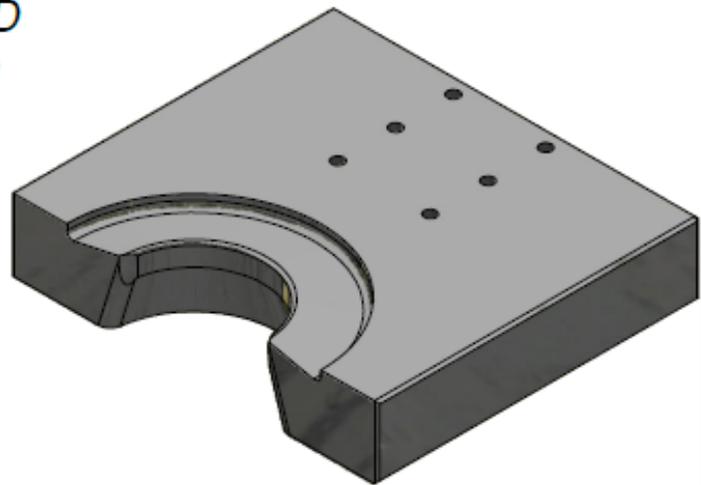
UNLESS OTHERWISE NOTED: DIMENSIONS IN INCHES TOLERANCES:		DESIGN	DATE	WOODS HOLE OCEANOGRAPHIC INSTITUTION Deep Submergence Laboratory Challenger Drive, WOODS HOLE, MA, 02543	
DECIMAL	ANGULAR	Fred Denton	3/20/2016	TITLE	
.xxx ± 0.01	± 1 deg	CHKD		NPCC LARS CRANE FOR JASON	
.xxx ± 0.005		CHECKED		LATCH DETAIL	
BREAK ALL SHARP EDGES R0.02 MIN				SIZE	REV
MATERIAL				B	2
FINISH				DWG NO	
SEE APPLICABLE NOTES				SCALE	SHEET 1 OF 3

8 7 6 5 4 3 2 1

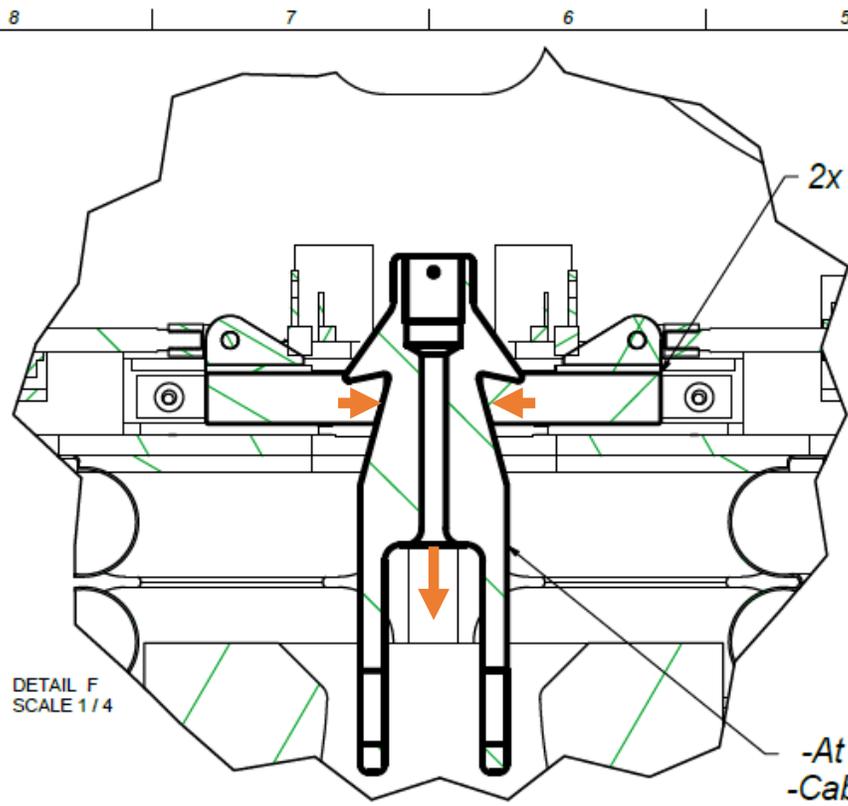


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LATCH ENGAGED
(HANDLE HELD)



ALL DIMENSIONS UNLESS OTHERWISE NOTED DIMENSIONS IN INCHES TOLERANCES: DECIMAL: .xx ±0.01 ANGULAR: ±1 deg .xxx ±0.005 BREAK ALL SHARP EDGES R0.02 MIN MATERIAL: UNSPECIFIED FINISH: SEE APPLICABLE NOTES		DESIGN: Prof Denton DATE: 3/29/2016 CHECKED:	WOODS HOLE OCEANOGRAPHIC INSTITUTION Deep Submergence Laboratory Challenger Drive, WOODS HOLE, MA, 02543
TITLE: NPCC LARS CRANE FOR JASON LATCH DETAIL		SIZE: B DWG NO:	REV: 2 SHEET 1 OF 3

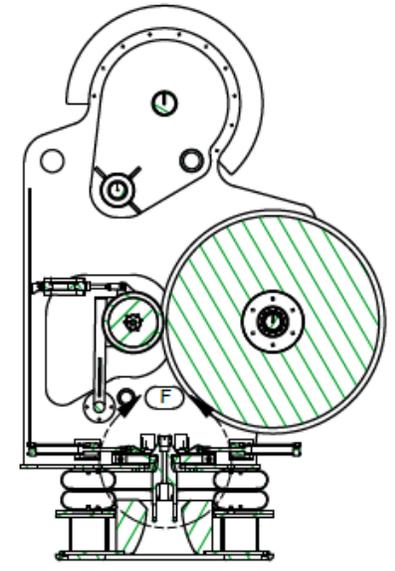
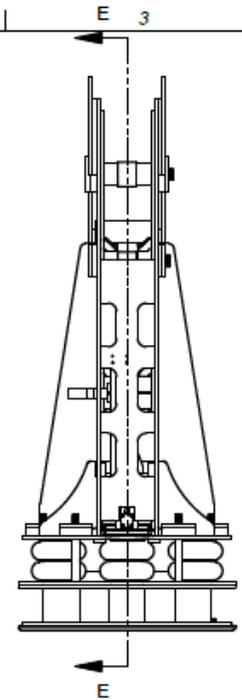


2x Latch Plates

DETAIL F
SCALE 1/4

Docking Bullet

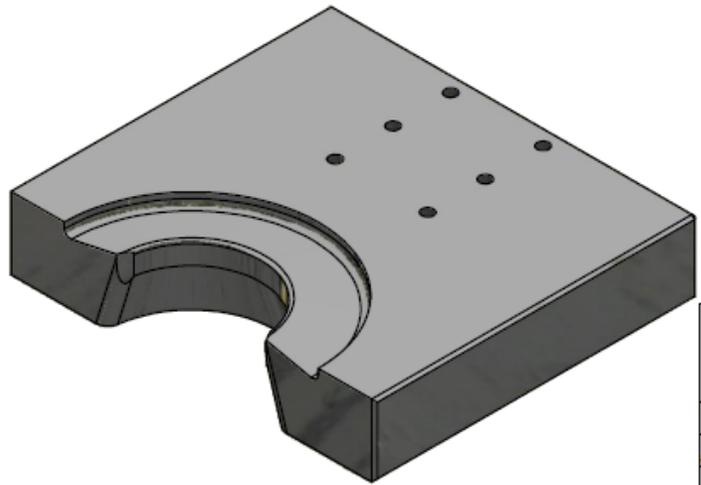
- At top of Jason on a 2-axis pivot
- Cable Termination screws into top



SECTION E-E
SCALE 1/24

3

*Bullet Lowered
with winch*



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DECIMAL	ANGULAR	Prof Denton	3/29/2016	TITLE	
.XX ± 0.01	± 1 deg	DRSPT		NPCC LARS CRANE FOR JASON	
.XXX ± 0.005		CHECKED		LATCH DETAIL	
BREAK ALL SHARP EDGES R0.02 MIN				SIZE	DWG NO
FINISH	SEE APPLICABLE NOTES			B	2
				SCALE	SHEET 1 OF 3