

KSC SAFETY VARIANCE REQUEST		NASA Control Number KSC- 2007- 0004
1. Date of Request 11/06/06	2. Duration (Not to Exceed 1 Year) From 12/4/06 To 12/3/07	3. Variance Type (Circle One) Deviation Waiver
4. Requesting Organization (Enter Company Name) USA/SPOC		5. Location of Variance Vehicle Assembly Building (K6-0848)
6. Document and Section (Unmet Requirement) NASA NPR 8715.3 - General Safety Program Requirements, Para. 3.11 – Explosive, Propellant, and Pyrotechnic Safety (3.11.1 & 3.11.2)		7. NASA Program (Select One) <input checked="" type="checkbox"/> Shuttle <input type="checkbox"/> Payloads <input type="checkbox"/> ELV <input type="checkbox"/> SE&T <input type="checkbox"/> Institutional <input type="checkbox"/> Space Station <input type="checkbox"/> Other
8. Specify Mission Number All missions during Variance duration	10. Safety Program (Select One) <input checked="" type="checkbox"/> Explosives, Propellants & Pyrotechnics <input type="checkbox"/> Lifting Devices & Equipment <input type="checkbox"/> Lightning & Grounding <input type="checkbox"/> Pressure Vessels <input type="checkbox"/> N/A	
9. Specify Mission/Project Name CoF – VAB Doors/Openings Refurbishment		
11. Will this activity expose NASA Personnel to hazardous conditions? If YES, contact AFGE Local 513. <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
12. Is Procedural Change Required? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	13. Specify Procedure N/A	
14. What is the specific requirement(s) that cannot be met (including document and section reference)? The below requirements are requested to be waived for approximately one-hundred ten (110) construction personnel working in the VAB integration bays. These personnel are considered non-essential for the Shuttle processing hazardous operations.		
<p>NPR 8715.3 General Safety Requirements paragraph 3.11 (Explosive, Propellant and Pyrotechnic Safety), 3.11.1 states that Center Directors and project managers shall use NSS 1740.12, Safety Standard for Explosives, Propellants and Pyrotechnics, for protecting personnel and property from hazards of explosives materials, including all types of explosives, propellants (liquid and solid), oxidizers and pyrotechnics (requirement 25151); paragraph 3.11.2 states that Center Directors and project managers shall ensure that explosive, propellant and pyrotechnic operations are conducted in a manner that exposes the minimum number of people to the smallest quantity of explosives for the shortest period consistent with the operation being conducted (Requirement 32349);</p> <p>The NSS 1740.12, Safety Standard for Explosives, Propellants and Pyrotechnics, requirement that will be waived is paragraph 201 (Personnel Limits), 201a: Jobs not necessary to the performance of a hazardous explosives operation shall not be performed in the same location as the hazardous operation. Personnel not needed for the hazardous operations will not be allowed in the hazardous locations.</p> <p>There are two basic scenarios that require non-essential construction personnel to be located in normal “clear” zones during Shuttle processing hazardous operations:</p> <ol style="list-style-type: none"> 1) Working in adjacent stacking bay using crane operations (commonly called “dual operations”) during non-dynamic/static periods 2) Working in HB1 or 3 (stacking or adjacent bay) on door opening siding replacement during non-dynamic/static periods 		

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15. What is the rationale for not meeting the requirement(s), what other options were considered, and what was the rationale used to disposition/discard these options?

Structural refurbishment of the VAB is a necessity. The VAB is the only facility capable of processing the Shuttle and deterioration of the structure has been severe over the past 40 years. NASA's VAB Wind Resistance Study (KSC-TA-5761) revealed severe corrosion in the building siding, particularly the dark colored siding that surrounds door openings. Years of environmental exposure and severe weather (such as the hurricanes of 2004 and 2005) have deteriorated the condition of the exterior siding such that it has become a risk to personnel and flight hardware. There are basically two options for refurbishment activities: 1) cease Shuttle processing and perform infrastructure repairs; 2) integrate Shuttle and infrastructure repairs. Infrastructure repairs will require several years to perform and therefore, integrating Shuttle processing and structural repairs is the only viable option. Therefore, obtaining Safety Variances to perform the infrastructure repairs is required.

- A) Performing "dual operations" is a common practice (Reference approved USA Safety Variance Request U2006-008). Dual operations allow structural refurbishment activities to be performed in non-stacking bays during non-dynamic stacking periods.
- B) Replacing the siding surrounding the opening of the stacking bay Vertical Lift Doors is required to protect the interior of the building, including flight hardware. Replacing the siding has become an infrastructure and Program priority.

HB1 Vertical and Horizontal Door Opening siding is in the process of being replaced (80% complete) and was scheduled for completion prior to the Bay being re-established as a stacking bay. The work has been interrupted on numerous occasions due to inclement weather and VAB Stacking Operations (see Block 30). Therefore, completing the siding replacement will require simultaneous operations (infrastructure refurbishment and Shuttle processing) within the stacking bay. The other possible option that was considered (besides allowing siding replacement during non-dynamic processing in the stacking bay) was to postpone the refurbishment tasks until stacking is completed. This is not considered an acceptable option due to the following: Equipment installed on the exterior of HB1 (FRACO Mast Climber) is needed for HB3 siding replacement, also, but the magnitude of the relocation efforts, cost and schedule dictate that HB1 be completed prior to beginning HB3 tasks. HB3 schedule will also be negatively impacted if HB1 work is delayed. The impact to HB3 schedule could be mitigated by leasing another Mast Climber and fabricate Mast climber ties for HB3. The cost (hundreds of thousands of dollars) and time (4-6 months) required to obtain a Mast Climber and fabricate the ties is unacceptable. It is estimated that HB1 siding replacement can be completed within the first Shuttle flow (STS-117) if the variance is approved.

All subcontractor work is prohibited during "up and over lifts" of flight hardware from the transfer aisle into the "stacking bay". Work will be allowed in the interior of HB3 (no exterior work allowed) if: (1) work area and egress is outside the safety controlled area established for HB 1 or other VAB hazardous operations, and (2) flight hardware is static, and/or softmate operations are in progress.

16. Have any design features or procedural controls been eliminated or compromised which would affect the safe operation of the system/operation?

Assuming the variance is approved, the procedural control for clearing the controlled areas of non-essential personnel will be compromised. Based on current flight manifests and refurbishment schedules, the compromise for working on HB1 siding replacement will be realized only for STS-117 processing. HB3 work (the requests for dual operations) will be realized throughout 2007. The basic compromise of the two scenarios is that the infrastructure refurbishment workers will be in the upper levels (above floor level 10). (Referenced attached drawings/sketches for location of workers in proximity to Shuttle processing). Normal clears during stacking operations for the requested variances (with requested exception in parentheses):

- A) "Dual Operations" requested for non-dynamic stacking periods: clears normally are the stacking bay and adjacent towers (allow entering/egressing through E-Tower by establishing a secondary badge board)
- B) "Replacing door opening siding in the stacking bay" during non-dynamic periods: normally, the stacking high bay and adjacent towers are cleared of all non-essential personnel (infrastructure workers will be located in the upper levels of the door openings, including the counterweight wells; ingress/egress will be through adjacent bay towers and elevators)

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17. What additional measures or controls have been taken to minimize risk to personnel, facilities or flight hardware, thus ensuring a safe operation in lieu of the requirement?

All subcontractor work is prohibited during "up and over lifts" of flight hardware from the transfer aisle into the "stacking bay". Exterior work is prohibited during dynamic moves of SRBs. Restrictions will be placed on the quantity of working personnel to limit the workers during normally "cleared" periods to those essential to meeting refurbishment and manifest schedules. Restrictions will be enforced through safety reviews and informative discussions at weekly safety talks/briefings regarding the permitted areas of entry, through the use of security escorts to monitor worker locations and through additional signage posted to designate areas of acceptable entry. Additional netting will be installed (reference drawing/sketch) in the stacking bay to ensure no components (if accidentally released) could reach the flight hardware. Also in the stacking bay, doors will remain closed as much as possible to complete the refurbishment work (it is anticipated that the doors will remain closed at all times). No open flames/torching will be permitted in the stacking bay while flight hardware is in the Bay. Tools and materials will be tethered where possible. Additional control measures are also detailed in the attached Risk Assessment.

18. How has the number of people exposed to the potential hazard been minimized?

Only the minimum quantity of personnel required to complete the critical path refurbishment activities on schedule will be permitted to work in normally cleared zones. A secondary badge board will be set up to insure the quantity is minimized.

- A) "Dual operations" – approximately 110 +/- 10 workers will be present at any given time. Not all of those workers will be working critical path tasks and, based on KICS Shuttle processing manifest, will be reduced to critical path workers only during normally cleared time periods.
- B) "Replacing door opening siding in the stacking bay" during non-dynamic periods will involve approximately 25 workers. They will be located in the upper levels of the Vertical Lift Door openings and counterweight wells. (Reference drawings/sketches). The work force size will be limited to those who can effectively replace the siding and paint associated steel structures.

19. How has the amount of hardware exposed to the hazard been minimized?

It is anticipated that HB1 siding replacement and Mast Climber demobilization can be completed during the STS-117 stacking process, assuming weather interruptions are minimal. Dual 6-days/week shifts are scheduled to support the schedule. To protect flight hardware, debris netting will be installed between the work area and the flight hardware (reference attached drawing/sketch). In addition, tools and large bolts will be tethered. Also, just prior to installing the first bolt into the Siding, the Siding is clamped and tied to a rope to support installation. The Siding is also tied down onto the FRACO Mast Climber while being moved to it's installation location. While Flight Hardware is in HB-1, no work on the siding will be performed while the VLDs are open. For the two scenarios, noise generation will be limited so as not to interrupt flight hardware processing. Working in the adjacent bay ("dual ops") should pose no hazard to the stacking bay ops. Shuttle processing, VAB Safety and VAB Operations personnel are consulted on a daily basis to communicate infrastructure activities. Refurbishment Project Team members attend 07:30 Operations meetings and activities are posted on KICS.

20. What are the risks associated with failure to meet the requirement(s)? What are the risks associated with not approving this variance (i.e., is there an increased risk if the requirement must be met)?

A risk assessment was performed and is attached. Yellow risks were identified including inadvertent ignition of RSRM leading to death of non-essential personnel and damage to flight hardware.

Risk associated with not approving this variance: Building and siding corrosion is most severe on the east side of the VAB. Delaying the refurbishment increases the risk of damage to flight hardware. Literal breaches were encountered in VAB walls during the 2005 hurricane season thereby exposing internally stored equipment to falling debris, wind and water.

21. What is the likelihood of occurrence of a mishap with the identified controls in-place, and what are the consequences should the controls fail or a mishap occur?

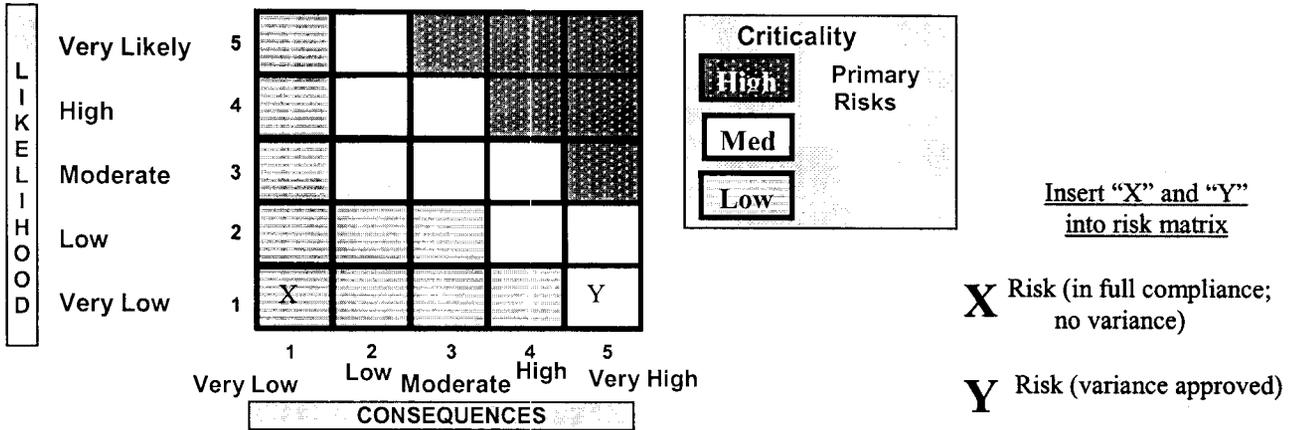
Please see the attached risk assessments for details. In summary, the likelihood of a mishap is extremely low. The consequences could be catastrophic, including the loss of life and/or flight hardware.

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22. Risk Matrix - Please see the attached Risk Assessments.

5 X 5 Risk Matrix



23. What is the plan for ensuring future compliance or partial compliance, thereby eliminating the need for future variances? The plan is to complete the refurbishment activities as quickly as possible and reduce the amount of exposure to personnel and flight hardware. Working dual shifts on critical path items will help insure completion in a timely manner. USA Operations has coordinated in the past and it is anticipated they will cooperate in the future, to perform dynamic stacking operations on second and third shifts, thereby reducing the interruptions to refurbishment activities and minimizing the quantity of personnel exposed to the risk.

24. Comments and/or Rationale for Disapproval:

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ORGANIZATION	Approval Level (Circle One)	SIGNATURE/DATE		MAIL CODE	PHONE
25. Initiator	Approval <input checked="" type="radio"/> Yes No N/A	Mark A Sortman 11/19/06		USK-730	750-4122
System Engineer	Approval Yes No N/A	Philip Shibly 1/20/06		USK-135	861-8486
Contr. Safety Director <i>Conzilzi 1/21/06</i>	Approval <input checked="" type="radio"/> Yes No N/A	Jamie McLean		USK-291	861-5461
Engineering Tech. Mgr.	Approval <input checked="" type="radio"/> Yes No N/A	Bradley McCom		USK-455	861-3362
Integration & Test Ops Mgr.	Approval <input checked="" type="radio"/> Yes No N/A	Jeffery P. McAlear <i>M.P. McAlear FOR</i>		USK-217	861-7416
Safety Ops Mgr	Approval <input checked="" type="radio"/> Yes No N/A	Donald Clarkson 11-17-06		USK-399	861-5883
FL Safety and Health Mgr	Approval <input checked="" type="radio"/> Yes No N/A	Donald Paniale		USK-142	861-2410
Infrastructure Program Mgr	Approval <input checked="" type="radio"/> Yes No N/A	Mark Terseck		USK-277	867-3625
MetCon Exec. VP	Approval Yes No N/A	Jeffrey L. Gibson 11/20/06		MetCon	632-4880
GO-APM	Approval <input checked="" type="radio"/> Yes No N/A	Mark D. Nappi 11/21/06		USK-383	861-3882
GROUND SYSTEMS M-9	YES	R. B. Buehler		NE-M-A	1-3258
Shuttle Processing CE	YES	<i>[Signature]</i>		NE-D	1-3800
26. NASA/KSC					
System Engineer	Concurrence <input checked="" type="radio"/> Yes No N/A	Lauren Price <i>Lauren Price</i>		NE-M9	861-5110
Safety Program Mgr	Concurrence <input checked="" type="radio"/> Yes No N/A	Stephen Brown <i>[Signature]</i>		SA-E3	867-6959
S&MA Div Chief	Concurrence <input checked="" type="radio"/> Yes No N/A	Laura Maier <i>Laura Maier</i>		SA-B	861-7901
Chair, Ground Risk Review Panel (GRRP)	Concurrence <input checked="" type="radio"/> Yes No N/A	John Branard <i>John Branard</i>		EA-C	867-2268
Other (Optional)	Concurrence <input checked="" type="radio"/> Yes No N/A	Grant Watson <i>[Signature]</i>		SA-L	867-8926
27. Project Director	Acceptance <input checked="" type="radio"/> Yes No N/A	Michael Wetmore <i>Rita Wilkerson for</i>		PH	867-4943
28. Director of S&MA	Concurrence <input checked="" type="radio"/> Yes No N/A	Shannon Bartell FOR <i>[Signature]</i>		SA	867-2118
29. Center Director	Acceptance <input checked="" type="radio"/> Yes No N/A	James Kennedy 12/4/06 <i>[Signature]</i>		AA	867-3373
30. USA Safety Evq.	Acceptance <input checked="" type="radio"/> Yes	Roger E. Paul		USK-291	861-31

KSC SAFETY VARIANCE REQUEST CONTINUATION SHEET

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30. Additional information provided for Block Number 15, Item B Date November 17, 2006
The following is a brief outline of the unplanned interruptions affecting the installation of the FRACO Mast Climber and replacement of the Opening siding:

	<u>Weather</u>		<u>"Operations"</u>	
	<u>Partial Days</u>	<u>Whole Days</u>	<u>Partial Days</u>	<u>Whole Days</u>
October ('05)	5	13	0	1
November	3	3	1	4
December	0	3	0	0
January ('06)	4	2	7	0
February	2	2	3	0
March	7	4	3	0
April	3	4	3	2
May	4	1	1	1
June	9	3	6	1
July	12	0	5	3
August	6	4	3	0
September	4	0	3	3
October	6	2	2	2
Total:	65	41	37	17

31. Additional information provided for Block Number _____ Date _____

NO.	REV. NO.	DESCRIPTION	DATE	APPROVED
1	A	GEN. REVISIONS TO COMPLY WITH AMENDMENTS NO. 1 THROUGH 44	2-11-64	JWJ
2	A	FINAL AS BUILT	4/10/64	WCPH
3	C	REVISED FOR F.O.D. INDEX	1-4-67	
4	D	T.D. NO. CHANGED FROM 100.00 TO 100.00	5-27-68	WCPH

NOTE: Δ REVISION \triangle INCORPORATES C.O.T.M.

RECORD DRAWING NOTE
 Shall be: Provide, Install, Remove, etc. indicates work was accomplished under the contract.

FINISHED FLOOR LEVELS ABOVE FLOOR LEVEL 0'-0" IN TOWERS

42. TOP OF PROOF SLAB @ LEVEL + 525'-7"
 41. TOP OF UPPER STEEL CHORD @ LEVEL + 525'-3"
 40. (WATER STORAGE TANK IN TOWER 'A')

457'-9" (ELEV. MACHINE ROOMS, TOWER 'D')

381'-3" (ELEC. SUB-STATION, TOWER 'D')

345'-9" (ACCESS TO EXTENSIBLE WORK PLATFORMS TYPE A, TOWER 'D')
 331'-1" (FL. & CLG. SLAB ONLY IN TOWER 'A') (ACCESS TO FLOOD LIGHTING)

305'-3" (WATER STORAGE TANK IN TOWER 'A')
 ACCESS TO EXTENSIBLE WORK PLATFORMS TYPE B, TOWER 'D')

242'-5" (ACCESS TO EXTENSIBLE WORK PLATFORMS TYPE C, TOWER 'D')

185'-8" (ACCESS TO EXTENSIBLE WORK PLATFORMS TYPE D, TOWER 'D')

115'-9" (ELEC. SUB-STATION & A.C. EQUIPMENT ROOMS, TOWER 'D' & 'A')

77'-9" (ACCESS TO JIB CRANE)

46'-1" (ELEC. LEVEL DIVICES & CABLES FROM A.C. TO TOWER 'D' & 'A')
 39'-9" (SPACE IN TOWER 'A')
 27'-1" (SPACE IN TOWER 'A')
 14'-5" (SPACE IN TOWER 'A')
 0'-0" (PIPES FROM UTILITY ANNEX IN TOWER 'A')



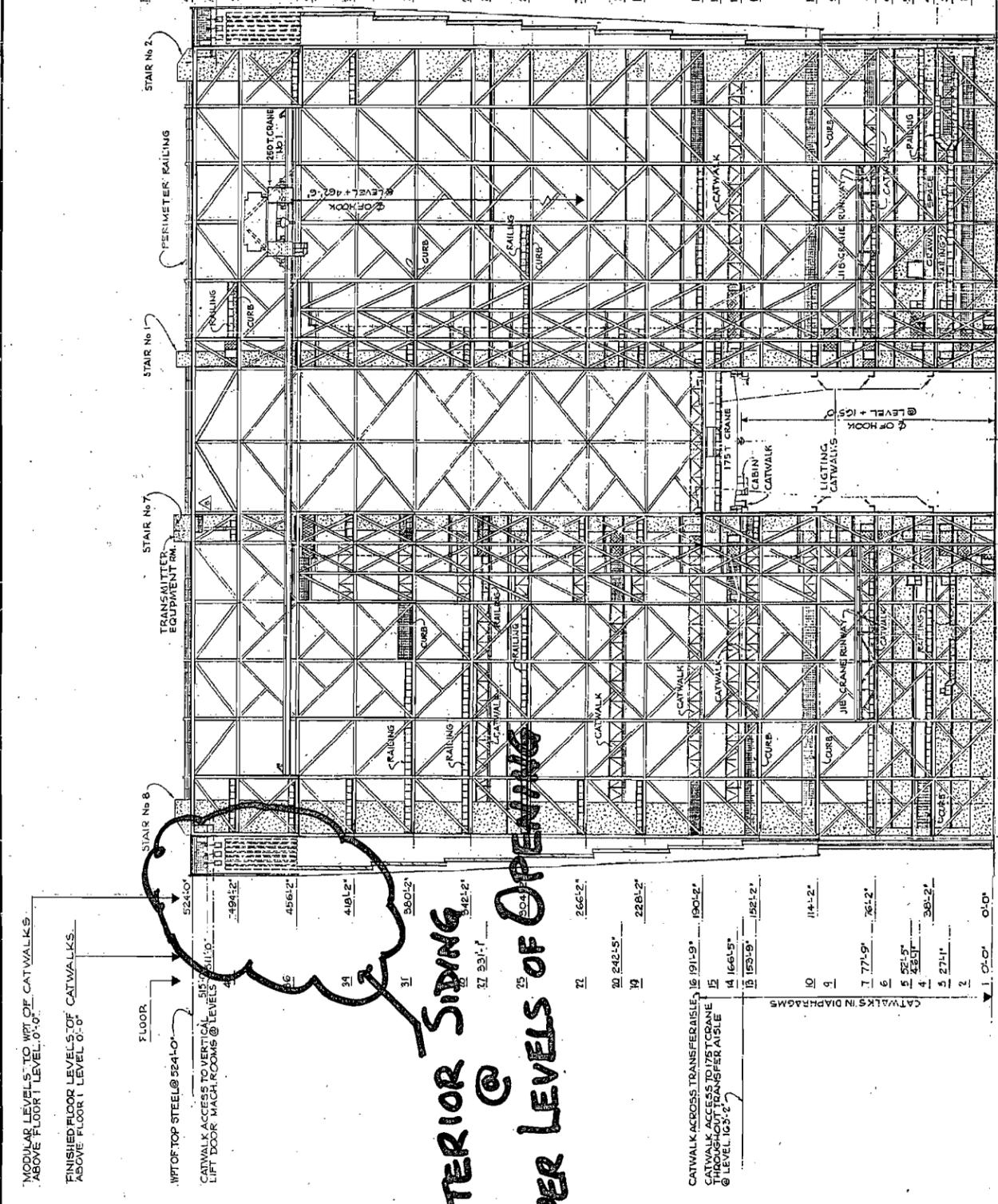
AS BUILT
 APPROVED BY: [Signature]
 DATE: [Date]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
 LAUNCH OPERATIONS CENTER

US ARMY ENGINEER DISTRICT, WASH. DC
 NEW YORK, N.Y.
 JACOBSVILLE, VA.

NASA, WERBITT ISLAND LAUNCH AREA
 WERBITT ISLAND, FLA.
 LC 39 VERTICAL ASSEMBLY BUILDING
 HIGH BAY AREA
 TRANSVERSE SECTION R-R

BY: NO. 508, R.A.S.A. (E.C.R. 44-13) SET 1 REF. NO. 2001 200
 DATE: 10/20/67 1967
 SCALE: 1/32\"/>



MODULAR LEVELS TO WPT OF CATWALKS ABOVE FLOOR LEVEL 0'-0"

FINISHED FLOOR LEVELS OF CATWALKS ABOVE FLOOR LEVEL 0'-0"

WPT OF TOP STEEL @ 554'-0"

CATWALK ACCESS TO VERTICAL LIFT DOOR MACH. ROOMS @ LEVELS 40, 37, 36, 34, 31, 28, 27, 25, 22, 20, 19, 16, 15, 14, 13, 10, 9, 7, 6, 5, 4, 3, 2, 1

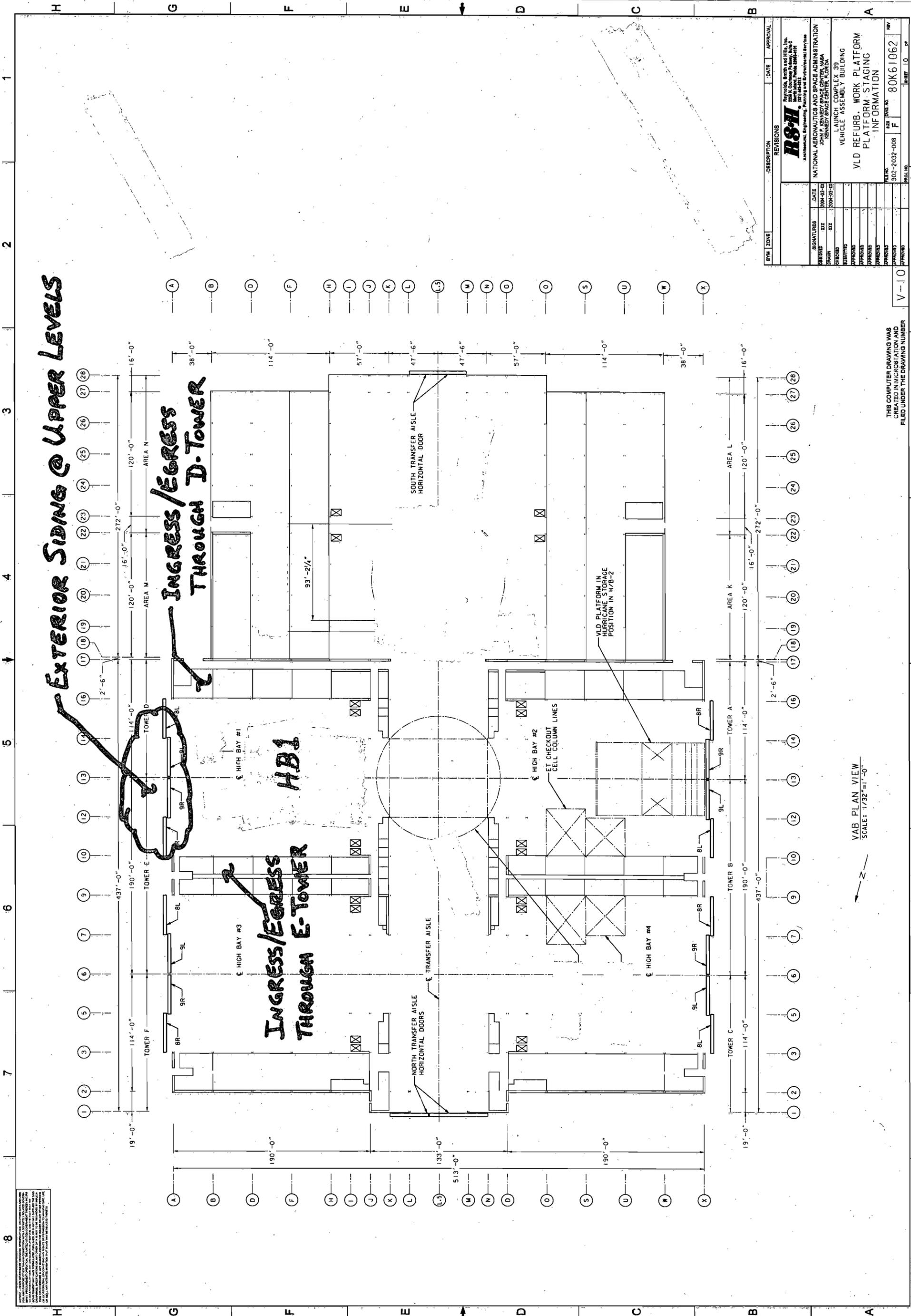
EXTERIOR SIDING @ UPPER LEVELS OF OPENING

CATWALK ACCESS TRANSFER AISLE @ LEVEL 105'-2"

VRB EAST SIDE

- NOTES:
1. FINISHED FLOOR IS TOP OF CONC. FLOOR SLAB, 4" ABOVE TOP OF STEEL FRAMING EXCEPT FLOOR 1.
 2. FOR EXTENSIBLE WORK PLATFORMS BETWEEN COL. LINES D & H SEE DWG. G-5-867

1A39.02.00.1ADA045.00



EXTERIOR SIDING @ UPPER LEVELS

INGRESS/EGRESS THROUGH D-TOWER

INGRESS/EGRESS THROUGH E-TOWER

HB1

SOUTH TRANSFER AISLE HORIZONTAL DOOR

NORTH TRANSFER AISLE HORIZONTAL DOORS

ET CHECKOUT CELL COLUMN LINES

VLD PLATFORM IN HURRICANE STORAGE POSITION IN H/B-2

BY	ZONE	DESCRIPTION	DATE	APPROVAL

DATE	DESCRIPTION
2000-08-10	
2000-08-10	

DESIGNED BY	
CHECKED BY	
APPROVED BY	
DATE	

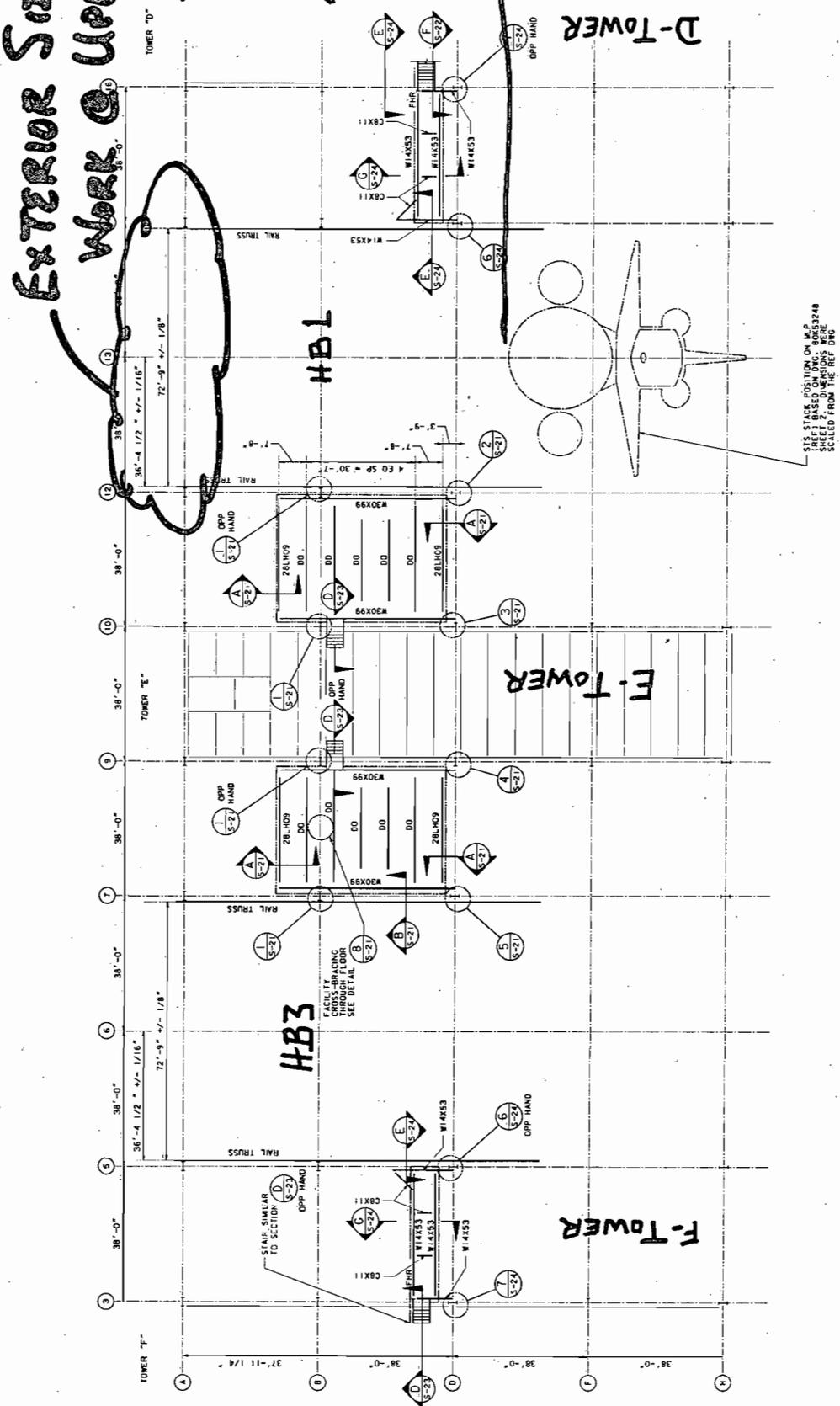
PROJECT NO.	302-2032-008
REV.	F
DATE	80K61062
BY	

VAB PLAN VIEW
SCALE: 1/32"=1'-0"

THIS COMPUTER DRAWING WAS CREATED IN MICROSTATION AND FILED UNDER THE DRAWING NUMBER

EXTERIOR SIDING WORK @ UPPER LEVEL

APPROX. 90°



STAIR POSITION ON MAP
 (REF) BASED ON UNO. 80K61062
 IN THE AREA OF THE
 SCALED FROM THE REF. UNO.

STS STACKING LOCATION

VAB PARTIAL PLAN FLOOR 32
 SCALE 3/32" = 1'-0"

8.4 0.0 8.16.24
 3/32 IN. = 1 FT

THE COMPUTER DRAWING WAS
 CREATED IN MICROSTATION AND
 PLOTTED UNDER THE DRAWING NUMBER

REV	ZONE	DESCRIPTION	DATE	APPROVAL

DATE	2006-07-27
PROJECT	VAB WORK PLATFORM & BARRIERS
LOCATION	LAUNCH COMPLEX 33
DESCRIPTION	VAB FACILITY MODIFICATIONS AT FLOOR 32
SCALE	3/32" = 1'-0"
UNO	80K61062
REV	

NOT TO SCALE
 DIMENSIONS SHOWN ON THIS DRAWING TAKE PRECEDENCE OVER DIMENSIONS SHOWN ON ANY OTHER DRAWING.
 ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE NOTED.
 ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE NOTED.
 ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE NOTED.

SAFETY RISK ASSESSMENT

Title: Vehicle Assembly Building Construction Activities Inside High Bay 1 RSRM Reduced Safety Controlled Area With The Crane Static

Description: In order to support contractual obligations for the HB1 project, USA's contract management has identified the need for allowing Vehicle Assembly Building (VAB) construction tasks to continue within the High Bay (HB) 1 reduced Reusable Solid Rocket Motor (RSRM) safety controlled area with the overhead crane and RSRM static during STS-117 assembly. An alternative option would be to stack STS-117 RSRMs in HB 3 and roll the partial stack into HB 1 to complete the Vehicle assembly.

USA's subcontractor Met Con will have completed High Bay (HB) 1 Horizontal and Vertical Door renovations and repairs by mid-November. However, there is exterior siding adjacent to the Doors that requires replacement and there is the need to dismantle the construction equipment used in support of the siding replacement. These tasks will not be completed until after stacking of STS-117 Vehicle has commenced in HB1.

Approximately twenty-six personnel are required to complete the sixty to seventy feet of upper canopy area between top vertical door and roof, the north and south counter weight wells (including flat panel siding), and to remove the Mast Climber equipment. All 26-construction workers will be required to egress to and from their workstations through the safety controlled area. Approximately ten of these workers will be in the interior of the facility located in HB1. Technically, construction personnel working the exterior siding are outside the safety controlled area. However, these exterior personnel are exposed to the same risks as the personnel who are working the interior of HB1.

The NASA Safety Standard for Explosives, Propellants, and Pyrotechnics, NSS 1740.12, and the Florida Safety Operating Plan FSOP 6100, Vol. 2, have requirements that either prohibit having non-essential personnel for the hazardous (explosive) operation in the hazardous location or that would prohibit contractor personnel working in any safety controlled area.

To date, operational impacts to USA and NASA construction contractors have been minimized by a limited flight schedule and through coordinated scheduling from both Shuttle Operations and VAB renovation contractors, implementation of engineering and/ or operational controls, and risk acceptance through the safety variance process. USA FSOP 6100 variance U2006-006, U2006-007 and U2006-008 are currently in place which allows contractor crew access through safety controlled areas, allows contractor operations when SRB segments are static and approximately 3 ft. from mate, and permits dual operations (i.e. hazardous operational operations and non-hazardous refurbishment operations in the hazardous location).

This risk assessment identifies the risk and scores the risk using the SFOC Risk Assessment Score Card. Risks will be presented to senior management and should management accept the risk, a safety variance will be required to permit limited VAB construction work in the safety-controlled area. To date, management has only accepted the risk of contractor personnel egress through the safety-controlled area.

Background: Age, weathering, minimal building maintenance and hurricane damage has necessitated the need for major renovation projects to restore the Vehicle Assembly Building (VAB) back to its original design requirements and operational configuration. Both NASA and USAGO are involved in the management of these projects.

Projects in work or scheduled over the next several years include roof repairs, High Bays 1, 2, 3, and 4 vertical and horizontal doors refurbishment; and replacement or refurbishment of the siding and translucent panels. Because of the strategic importance of the VAB to operational processing, it was determined that these renovation projects could only be completed in parallel with operational processing. It was also noted in the Request For Proposals (RFP) to contractors that construction interruptions would occur as the result of VAB processing operations.

Operationally, the VAB is the only KSC facility that can accommodate Space Shuttle Vehicle integration. Integration of the SSV is completed in either High Bay 1 or HB 3. RSRMs, a Class 1.3 explosive (mass fire), are usually present within the facility. While the RSRM quantity may vary, the facility is sited for a maximum of 16 segments for nominal operations. However, nominal operational quantities are currently limited to 8 RSRMs because of the HB 1 construction door work. This limitation will continue, as HB 3 door work will immediately follow HB 1 door work completion. Additionally, with an Orbiter present, the residual Nitrogen Tetroxide (N₂O₄), Monomethyl Hydrazine (MMH), and Hydrazine have an equivalency of approximate 450 pounds of TNT a Class 1.1 explosive. As a result, the VAB is designated a potential explosive site (PES) per the NSS1740.12.

It should be noted that during the months of May through November, HB 2 is designated as "Safe Haven" for hurricane contingencies. For short periods during a hurricane, the number of RSRMs in the VAB could increase to a maximum of 24 segments. Whenever hurricane preparations are activated, shuttle processing operations and VAB renovation activities cease as the facility is prepared for hurricane protection.

Shuttle Processing Operations

Nominally aft booster mate to the hold down posts is completed during 2nd and 3rd shifts. There are occasions where shimming operations extended into 1st shift. Center and forward RSRM stacking operations start on 2nd or 3rd shift with the lifting of the segment from the transfer aisle into a position approximately 3 ft. above SRB stack. Installation of the joint enclosure, RSRM measurements, and final joint preparations creates a 10 to 12 hour static period in the mate process. The task sequence that accomplishes final lowering from approximately 3 ft through soft mate takes technicians approximately 6 hours to complete. Consequently, final joint preparations and final joint mate nominally occurs during 1st shift.

Facility Renovations

Contractor operations introduce their own risks into the VAB environment. These risks include (1) "hot work" operations that could result in a fire and damage the VAB, (2) contractor tasks that introduce noise above background that could interfere with critical crane or other operations and may result in flight hardware damage, and (3) particulate contamination.

Currently there are approximately 180 contractor personnel participating in Vehicle Assembly Building door and roof renovation projects. However, for this assessment only the 26 personnel identified in the description are under consideration to be allowed access to and egress through the HB 1 safety controlled area.

Risk Categories:

- Table 1 – Operational Risks Incurred If VAB Renovation Contractors Allowed to Work In HB1 During STS Stacking
- Table 2 – Stack RSRMs in HB3, Roll Around To HB 1 (Option)

Risk Causes:

See table matrices

Consequences:

See table matrices

Likelihood of Occurrence:

See table matrices

Mitigation Options:

See table matrices

Impact to HRs/CILs/Safety Requirements: Safety variance required to (1) NASA General Safety Program Requirements NPR 8713.3A, para. 3.11.1 and para 3.11.2, (2) NASA Safety Standard for Explosives, Propellants, and Pyrotechnics, NSS 1740.12, para. 201a, and (3) USA Florida Safety Operating Plan (FSOP) 6100, Vol. II, appendix Q Operation 8,

ASSESSMENT MATRIX

Table 1 Operational Risks Incurred If VAB Renovation Contractors Allowed to Work In HB1 During STS Stacking:	Consequences		Likelihood	Risk Score	Mitigation
	Cat	Score			
A. Inadvertent RSRM ignition caused by failure of the overhead crane during final RSRM mate operations could result in the loss of life of non-essential VAB renovation contractor personnel.	Safety	5	1	5	<ul style="list-style-type: none"> • Crane design • Functional check of Crane for each flow • Scheduled crane maintenance • Crane operations are static when construction personnel are in the safety-controlled area
B. Inadvertent RSRM ignition caused by friction of the segment tang being mated against loose propellant in the SRB clevis joint during final mate could result in the loss of life of non-essential VAB renovation contractor personnel.	Safety	5	1	5	<ul style="list-style-type: none"> • Construction personnel performing HB1 renovations <u>will not</u> be permitted inside HB1 nor allowed to work the exterior siding during dynamic crane operations • Secondary badge board will be used to control construction personnel inside the reduced controlled area • Tang and clevis of RSRMs are cleaned and inspected numerous times prior to joint mate, including final inspection just prior to the final mate sequence.
C. Loud noise(s) created by renovation work and equipment while modifying the VAB structure interferes with critical tasks that could result in significant damage to critical elements or cause a less than 7-day slip in SSP milestone.	Safety	3	3	9	<ul style="list-style-type: none"> • Loud noise tasks are not permitted during critical operational tasks • Scheduling meetings are used to minimize conflicting tasks • Renovation tasks are closed down if the generated noise interferes with processing tasks
	Schedule	2		6	

Table 1 Operational Risks Incurred If VAB Renovation Contractors Allowed to Work In HB1 During STS Stacking:	Consequences		Likelihood	Risk Score	Mitigation
	Cat	Score			
D. Fires caused by renovation tasks could result in significant damage to a critical facility (VAB)	Safety	3	3	9	<ul style="list-style-type: none"> Hot work is not expected for exterior siding Hot work Mast Climber (haunch) disassembly operations will be completed after Vehicle is moved to Pad If hot work required <ul style="list-style-type: none"> Hot work permits Fire watch Fire alarms clear the entire VAB
E. Contractors working in counterweight wells are struck by counterweights during VAB Vertical Door operations resulting in permanent disability or death	Safety	5	1	5	<ul style="list-style-type: none"> Dual (USA and Metcon) Lockout Tagout procedure utilized Scheduling meetings
F. Contractor violates safety clear area, which could result in personnel injury or a minor operational slip.	Safety	3	2	6	<ul style="list-style-type: none"> Contractor safety briefings Control areas identified by safety signs and barriers Security escort observation in place
	Schedule	1		2	
G. Siding panels and/or other construction materials impact flight hardware causing significant damage to critical item.	Safety	3	1	3	<ul style="list-style-type: none"> Vertical and horizontal doors will be closed during all construction tasks (alternate venting configuration will be used) Counterweight “wells” provide “containment” and protect flight hardware during interior work Tethering policy enforced
	Schedule	3		3	

Table 1 Operational Risks Incurred If VAB Renovation Contractors Allowed to Work In HB1 During STS Stacking:	Consequences		Likelihood	Risk Score	Mitigation
	Cat	Score			
H. Contractor operations generate particulate contamination, which could contaminate RSRM joints or the LO2/LH2 ET connection resulting in damage to flight hardware and/or greater than a 7-day slip in an SSP milestone.	Safety	3	1	3	<ul style="list-style-type: none"> Contractor corrosion control uses "vacuum" control at point of operation Installed RSRM joint enclosures protect field joint during final mate tasks RSRM field joint inspections prior to soft final mate Projected completion of all HB1 Construction activities prior to ET mate ET contamination barriers protection during ET mate
	Schedule	3		3	
I. Falling debris from Mast Climber Bridge causes significant damage to flight hardware during rollout.	Safety	3	1	3	<ul style="list-style-type: none"> Mast Climber Bridge scheduled to be removed prior to rollout If bridge in place, pre-cleaning/FOD walk down by MetCon and USA personnel will be conducted
	Schedule	3		3	
J. Rainwater intrusion through building openings (removed siding) contaminates incomplete RSRM stack resulting in a schedule delay of greater than 30 days.	Safety	5	2	10	<ul style="list-style-type: none"> Minimize opening sizes Monitor weather Temporary siding coverings as required RSRM joint protection enclosure
	Schedule	4		8	

Table 2 Stack RSRMs in HB3, Roll Around To HB 1 (Alternative)	Consequences		Likeli- hood	Risk Score	Mitigation
	Cat	Score			
A. VLD Work Platform (Toaster) relocation cannot be completed due to operational interruptions (i.e. potential crane failure, fit, interferences, etc.) resulting in greater than 7-day slips in an SSP milestone, recovery cost between \$1M – 5M and a temporary loss in production.	Schedule	3	2	6	<ul style="list-style-type: none"> VLD Work Platform is scheduled for relocation during a period when operational interruptions has least impact on shuttle processing schedule
	Cost	3		6	
	Supportability	4		8	

Conclusion: Age, weathering, minimal building maintenance and hurricane damage has caused NASA to seek and award contractual bids for VAB renovations. It has been estimated that a minimum of seven years are required to complete all the renovations currently identified for the facility. Because these renovations are required to preserve the functionality of the facility, NASA made the decision to integrate and work the renovations in parallel with the operational environment of the Shuttle program, even though the facility is classified as an explosive site.

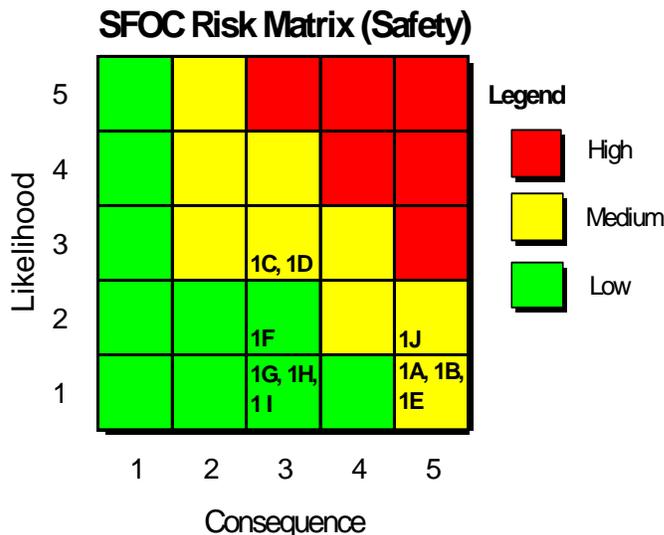
VAB safety requirements have a direct impact on VAB construction contractors and the tasks they perform. These impacts range from complete construction shut down during RSRM segment lift/softmate operations to daily exposure to explosives (RSRM propellant and Residual Hypergolic fluids) in a designated ordnance facility.

To date, a limited flight schedule, coordinated scheduling efforts between Shuttle Operations and VAB renovation contractors, implementation of engineering and/ or operational controls, and risk acceptance by senior management has minimized impacts to USA and NASA construction contractors.

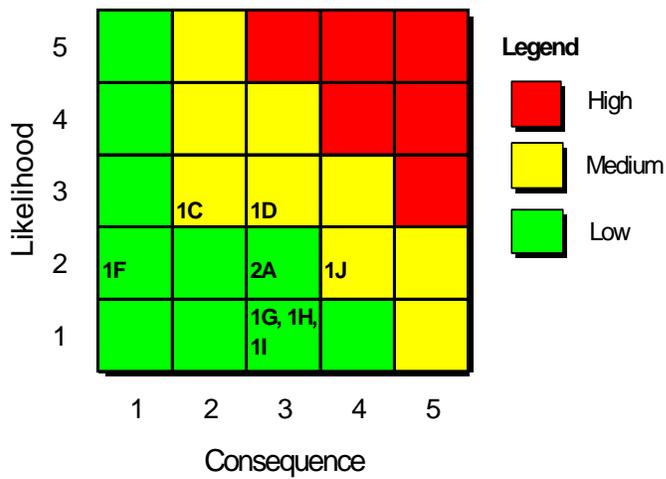
Three variances U2006-006, U2006-007, and U2006-008 authorize USA and NASA VAB construction contractor personnel access through safety controlled areas established for RSRM final mate preparations, when SRB segments are static and approximately 3 ft. from mate. Construction variances also permit dual operations.

Processing a variance to NPR 8713A, NSS 1740.12, and FSOP 6100 authorizing approximately ten construction personnel into a safety control area located in an active processing High Bay and authorizing and additional 13 construction workers egress to and from their workstations through the safety controlled area is contingent upon senior USA and NASA management accepting the risks presented in this assessment.

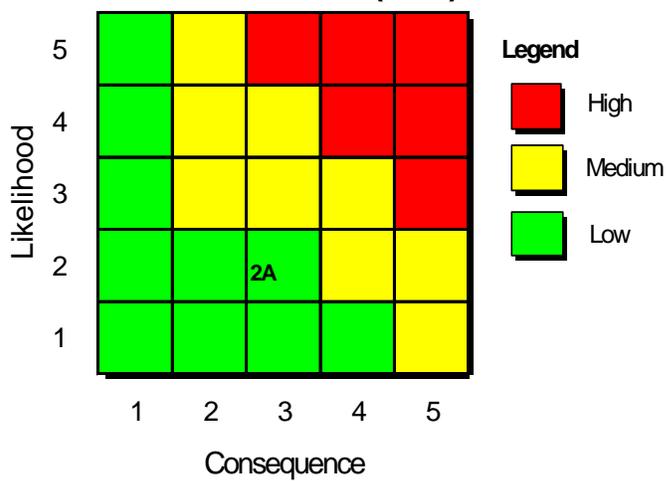
VAB construction personnel performing renovations and repairs to the HB 1 exterior siding are exposed to the same inadvertent RSRM ignition risks as the personnel inside the VAB interior areas.



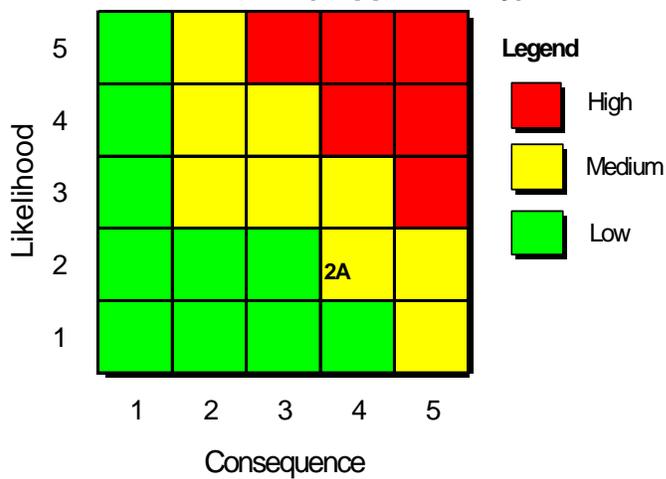
SFOC Risk Matrix (Schedule)



SFOC Risk Matrix (Cost)



SFOC Risk Matrix (Supportability)



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