

CHAPTER 8

LAUNCH SITE OPERATION

Launch Site Operation mainly includes:

- LV Checkouts and Processing;
- SC Checkouts and Processing;
- SC and LV Combined Operations.

The typical working flow and requirements of the launch site operation are introduced in this chapter. For different launch missions, the launch site operation will be different, especially for combined operations related to joint efforts from SC and LV sides. Therefore, the combined operations could be performed only if the operation procedures are coordinated and approved by all sides.

LM-2C uses JSLC as its main launch site. The launch site operations in JSLC are focused in this Chapter. The operations in XSLC are similar.

8.1 LV Checkouts and Processing

Two-stage LM-2C or LM-2C/CTS launch vehicle is transported from CALT facility (Beijing, China) to JSLC (Gansu Province, China) and undergoes various checkouts and processing in the North Technical Center and the South Launch Center. The typical LV working flow in the launch site is shown in **Table 8-1**.

Table 8-1 LV Working Flow in Launch Site

	No.	Item	Working Period	Accumulative Period	
T E C H .	1	To Unload LV from the Train and Transfer LV to LV Test Building (BL).	1 day	1 day	
	2	Unit Tests of Electrical System	7 days	8 days	
	3	LV Status Recovery before Transfer	3 days	11 days	
L A U N C H C E N T E R	4	To Transfer LV to the Launch Center and Erect LV on the Launch Tower	1 days	12 days	
	5	Tests to Separate Subsystems	2 days	14 days	
	6	Matching Test Among Subsystems	2 days	16 days	
	7	overall checkout on the first and second stages	2 days	18 days	
	8	To Mate SC/Fairing Stack with LV	1 days	19 days	
	9	CTS subsystem tests and matching tests	1 days	20 days	
	10	The First Overall Checkout	1 day	21 days	
	11	The Second Overall Checkout (Launch Rehearsal, SC Involved)	1 day	22 days	
	12	The Third Overall Checkout	1 day	23 days	
	13	Reviews on Checkout Results	1 days	24 days	
	14	Functional Check before Fueling, Gas Replacement of Tanks	1 days	25 days	
	15	N2O4/UDMH Fueling and Launch	2 day	27 days	
	Total			27 days	27 days

After SC is transferred to Launch Center, some of SC and LV operations can be performed in parallel under conditions of no interference.

8.2 Combined Operation Procedures

Take LM-2C/CTS launching multiple SCs as an example.

8.2.1 SC/LV Integration and Fairing Encapsulation in North Technical Center

In BS2 & BS3, SC team carries out all the SC operations. LV side is responsible for mating SCs with CTS and installing SC/LV separation devices. The following describes the typical working procedure:

1. In BS3, CALT to clean up the fairing halves and install wires and sensors on the inner surface of the fairing, and glue the thermal blanket (cork panel) on the outer surface of the fairing; SC side to prepare and perform SC testing;
2. In the assembly area of BS3, CALT to install the solid rocket motor on the CTS; CALT to move the CTS to the fueling area, to fuel RCS with hydrazine and perform gas-filling for the gas bottles; CALT to move the CTS back to the assembly area;
3. CALT to bolt the CTS with the supporting table through the LV Adapter;
4. SC side to hoist the fueled & weighed SCs overhead the CTS; CALT to mate SCs with CTS one by one;
5. CALT to encapsulate the fairing;
6. CALT to install explosive bolts on the fairing, and finally form a SC/Fairing stack;

Refer to **Figure 8-1**.

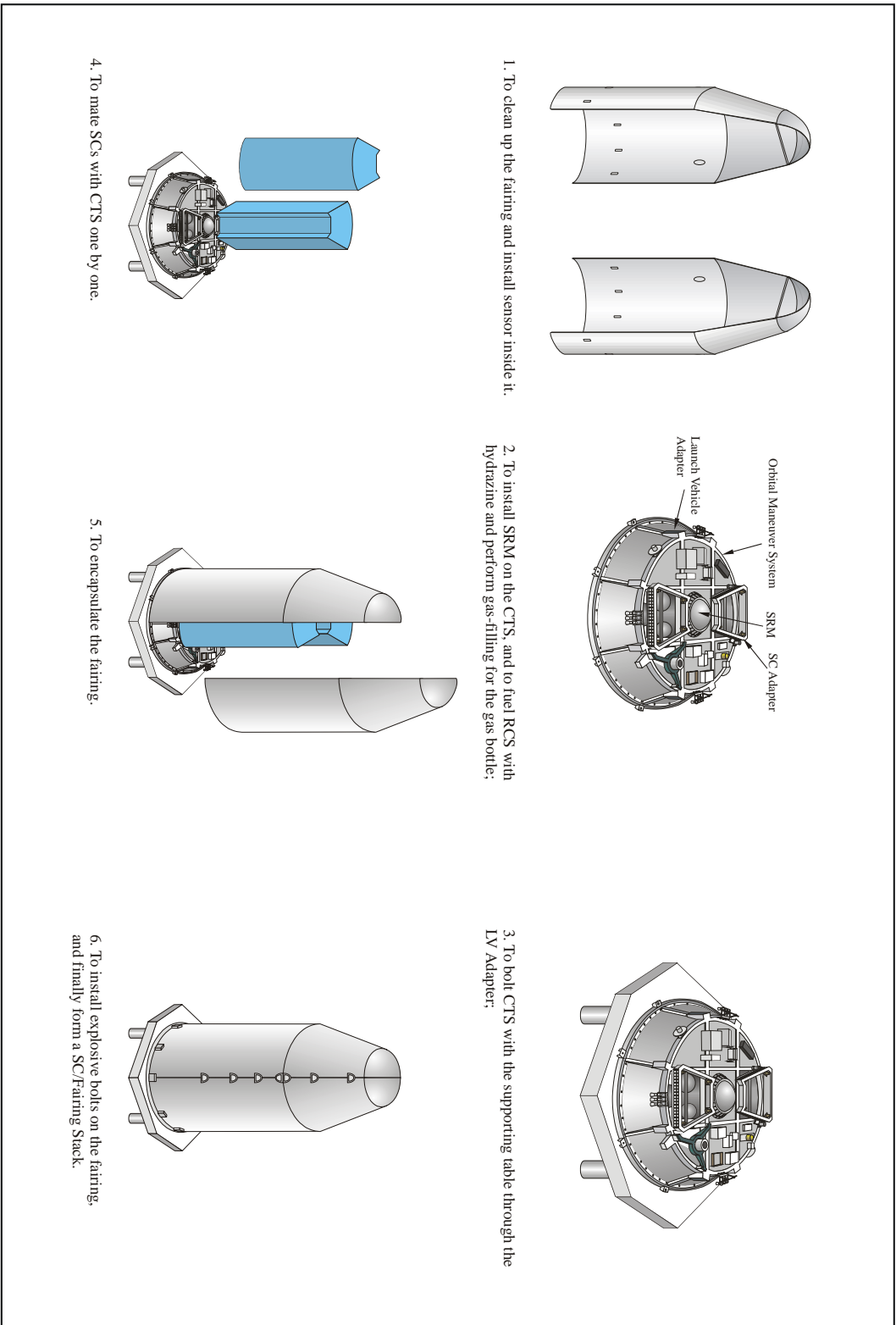


Figure 8-1 SCLV Integration and Fairing Encapsulation

8.2.2 SC Transfer and Fairing/Stage-2 Integration

CLTC is responsible for transferring the encapsulated fairing from BS3 to the North Launch Center. The following working procedures are performed:

7. CLTC to load the SC/Fairing stack onto the transfer trailer; CLTC to connect the transfer trailer with the tractor, and make the air-conditioning pipe connected to the encapsulated fairing, then get the temperature and humidity monitoring system ready; CLTC to transfer the SC/Fairing stack to the Launch Center;
8. CLTC to move the encapsulated fairing stack under the launch tower, and install hoisting sling;
9. CLTC to lift up the encapsulated fairing stack onto the stage-2 of LM-2C, which is already erected;
10. CALT to mate the encapsulated fairing with stage-2 of LM-2C;

Refer to **Figure 8-2**.

11. CALT to set up an air-conditioned closure for the SC/Fairing stack, and connect the air-conditioning pipes to the encapsulated fairing air-conditioned, then record the environment parameters inside the fairing;
12. CALT to connect the umbilical cable, SC side to monitor SC status and charge SC battery;
13. CALT to perform subsystem tests and matching test for CTS, SC side to perform SC testing;
14. CALT and SC side to conduct launch rehearsal (SC involved). This is the end of combined operations.

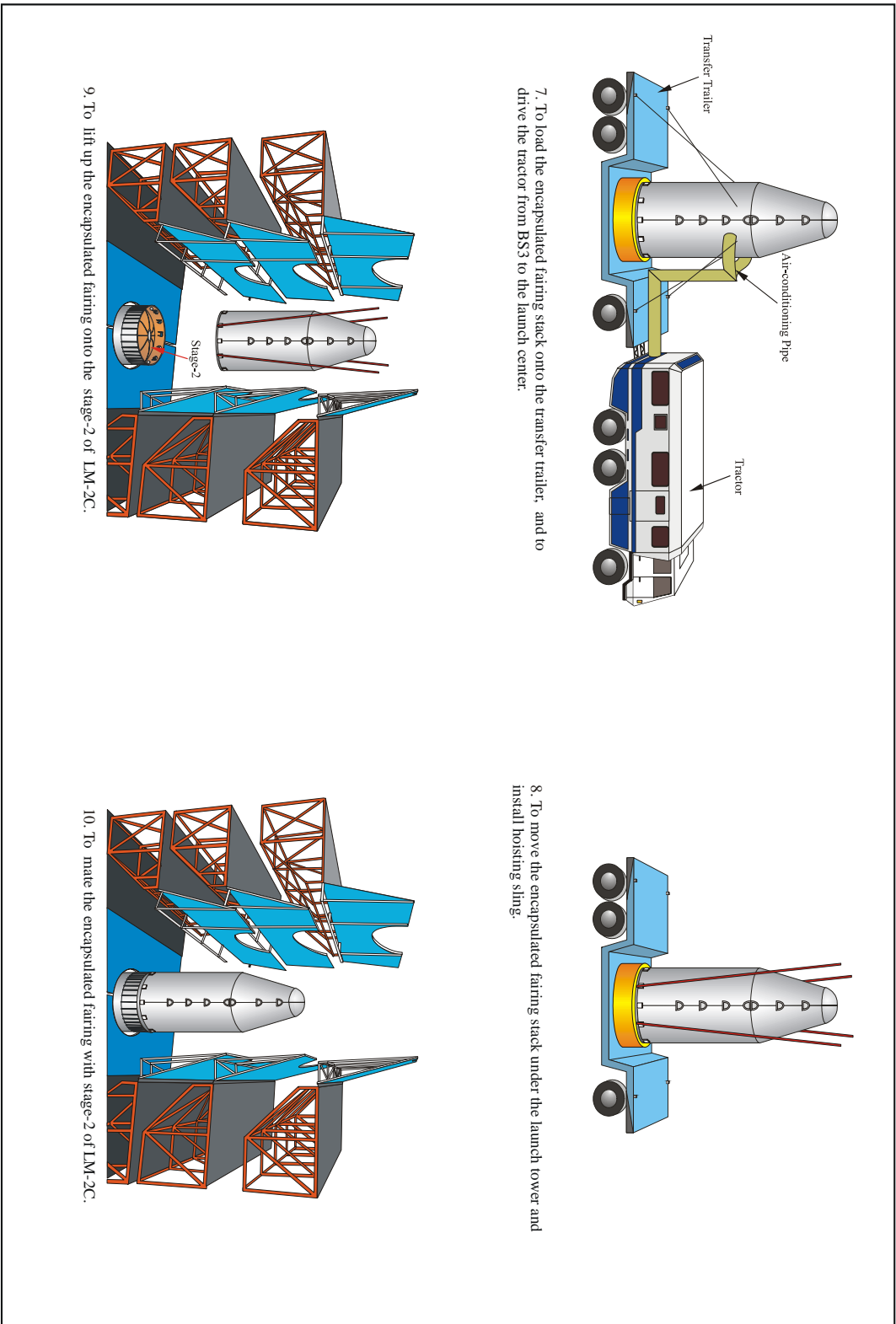


Figure 8-2 SC Transfer and Fairing/stage-2 integration

8.3 SC Preparation and Checkouts

- CALT and CLTC are responsible for checking and verifying the umbilical cables and RF links. If necessary, SC team could witness the operation.
- LV accessibility and RF silence time restriction must be considered, when SC team performs operation to SCs.

8.4 Launch Limitation

8.4.1 Weather Limitation

- Ambient temperature: $-10^{\circ}\text{C}\sim+40^{\circ}\text{C}$;
- Relative humidity: $\leq 98\%$ (corresponding to $20\pm 5^{\circ}\text{C}$)
- The average ground wind velocity in the launch area is lower than 10m/s
- The winds aloft limitation: $q\times\alpha\leq 4000\text{N/m}^2\cdot\text{rad}$ ($q\times\alpha$ reflects the aerodynamic loads acting on the LV, whereas, q is the dynamic head, and α is LV angle of attack.)
- The horizontal visibility in the launch area is farther than 20 km.
- No thunder and lightning in the range of 40km around the launch area, the atmosphere electrical field strength is weaker than 10kV/m.

8.4.2 "GO" Criteria for Launch

- The SCs' status is normal, and ready for launch.
- The launch vehicle is normal, and ready for launch.
- All the ground support equipment is ready;
- All the people withdraw to the safe area.

8.5 Pre-launch Countdown Procedure

The typical pre-launch countdown procedure in the launch day is listed below:

No.	Time	Event
1	-7 hours	Launch Status Preparation;
2	-5 hours	LV Power-on, Functional Checkouts on Each Sub-system
3	-4 hours	Connecting Plugs for Battery and Pyrotechnics
4	-3 hours	LV Status Checkouts, Sealing;

5	-2 hours	GSE Status Checkouts;
6	-90 minutes	Final Launch Status Preparation;
7	-60 minutes	SC side send "GO" signal; Battery air-conditioning stops; LV tanks are pressurized; Aiming;
8	-40 minutes	Flight Software Loading; One of Air-conditioning Pipes Drop-off;
9	-30 minutes	Moveable Platforms on the Umbilical Tower Withdrawal;
10	-15 minutes	Umbilical Disconnection;
11	-7 minutes	The Final Air-conditioning Pipe Drop-off;
12	-2 minutes	LV Power Switch Over, In-Flight-Disconnectors (IFD) Drop-off;
13	-1 minute	Swinging Arms Withdrawal;
14	-40 seconds	TT&C Systems Starting;
15	-5 seconds	Camera On
16	0	Ignition

8.6 Post-launch Activities

The orbital parameters of the injected orbit will be provided to Customer in half-hours after SC injection.

The launch evaluation report will be provided to the Customer in a month after launch.