PROSPECT OF SPACE DEBRIS MITIGATION RESEARCH IN CHINA FOR NEXT FIVE YEARS

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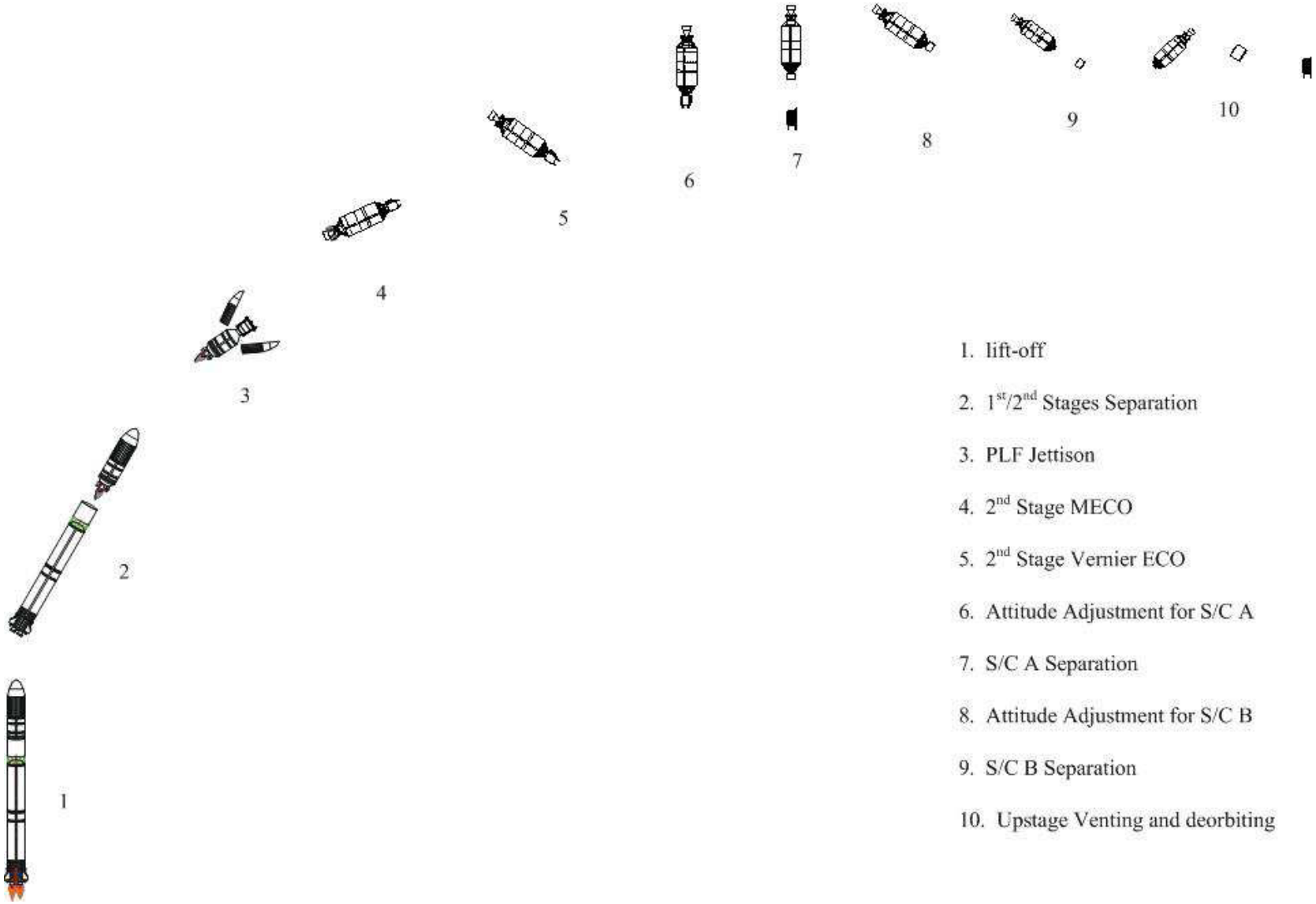
1. MAIN ACHIEVEMENTS IN "11th FIVEYEAR PLAN "

The space industry standard named “Orbital Debris Mitigation Requirements （QJ3221-2005）” was published in 2006. This standard put forward the principle requirements from the technological level for the Orbital Debris Mitigation in every steps of space activities. The requirements of this standard are consistent with that of “IADC Space Debris Mitigation Guidelines”. The series standards of Orbital Debris Mitigation design and administration are being developed based on this top level space debris standard.

1. MAIN ACHIEVEMENTS IN "11th FIVEYEAR PLAN "

By the end of 2010, Chinese Long March series launching vehicle have launched more than 100 times, including more than 10 times launched in 2010 and brought more than 10 satellites into the scheduled Orbit. Most of the launch vehicles take corresponding Debris Mitigation measures. For example, CZ-4B/C launched 4 times in 2010 and brought 7 satellites into the scheduled orbit, all the orbital stage of rockets completed the passivation operation, depleted thoroughly all the residual propellant after the separation of the satellite and the rocket, to eliminate the potential breakup on the orbit. In addition, Long March 2D launched 3 times in 2010 and initiatively took the active de-orbiting operation after the successfully separation of the satellite and rocket.

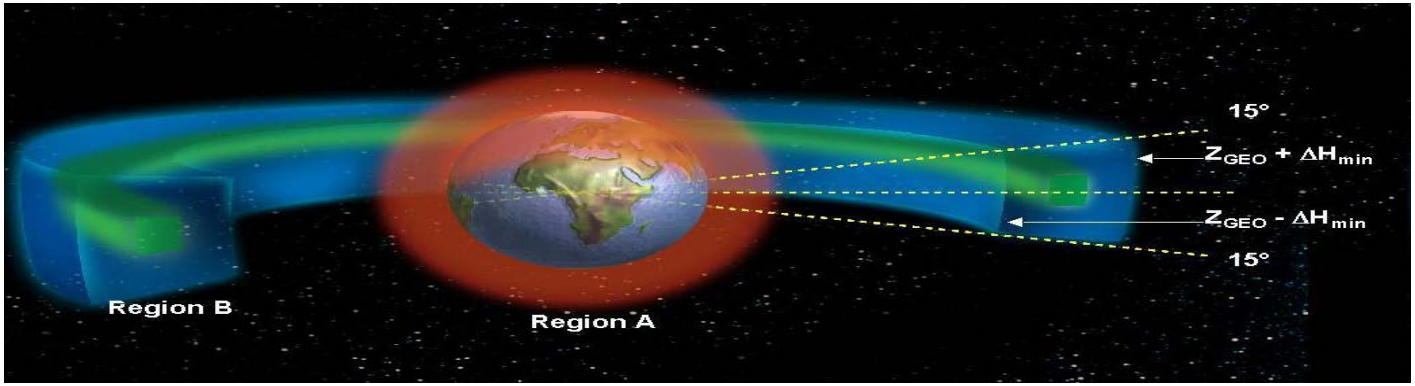


1. lift-off
2. 1st/2nd Stages Separation
3. PLF Jettison
4. 2nd Stage MECO
5. 2nd Stage Vernier ECO
6. Attitude Adjustment for S/C A
7. S/C A Separation
8. Attitude Adjustment for S/C B
9. S/C B Separation
10. Upstage Venting and deorbiting

10 Venting and Deorbiting of LM-2D

1. MAIN ACHIEVEMENTS IN "11th 5-YEAR PLAN "

In order to protect the geosynchronous region, which is the valuable space resource， FY-2A, FY-2B and Sinosat-2 GEO satellites successively took the reorbit disposal at the end of mission.



1. MAIN ACHIEVEMENTS IN "11th 5-YEAR PLAN "

Just as mentioned in the “UN Space Debris Mitigation Guidelines”， Space Debris Mitigation need every agency and government to implement through the state mechanism. China pay great regards to it, and has organized the experts from both the spaceflight fields and space policy fields to research the feasibility of Orbital Debris Mitigation design and administration. The requirements of the control managements in China have been established for the first time along with the publish of “ Management Requirement for Space Debris Mitigation and Protection”.

1. MAIN ACHIEVEMENTS IN "11th 5-YEAR PLAN "

Project

High Precision Measurement for Residual Propellant <3 Months

1. MAIN ACHIEVEMENTS IN "11th 5-YEAR PLAN "

Passivation Test for Satellite Battery

2. GOAL FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

① To break through the critical technology of the passivation and de-orbit;

② To build the evaluation laboratory of mitigation design and to establish the evaluation system of mitigation design;

③ To apply the disposal technology after the missions of the satellites and rockets to engineering application;

④ To fulfil the requirement of the guideline of LEO orbit mission less than 25 years and re-orbit requirements after GEO spacecraft’s missions;

2. GOAL FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

⑤To take part in the cooperation and discussion actively organized by the IADC organization;

⑥ To publish space debris standards and specifications;

⑦ To implement the various requirements of

“ Management Requirement for Space Debris Mitigation and Protection”.

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-1 THE SPACE DEBRIS MITIGATION DESIGN TECHNOLOGY AND ENGINEERING APPLICATION

- Disposal technology investigation regarding direct orbit manoeuvre (de-orbit or reorbit) after the missions;
- Disposal mission simulation regarding direct orbit manoeuvre (de-orbit or re-orbit) after the missions;
- Engineering implementation test using in orbit satellite.

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-2 THE EQUIPMENT RESEARCH OF SOLID RETRO-ROCKET FAIRING

- The adaptability design and dynamic load analysis regarding retro-rocket fairing under the vacuum condition;
- Influence analysis and controlling design of retro-rocket fairing regarding upper fairing opening process;
- The reducing weight design of upper fairing and of separation mechanism;
- The manufacture and assembly techniques regarding rapid release and locking mechanism of upper fairing;

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-3 THE ADAPTABILITY IMPROVEMENT OF TWO-STAGE OXIDANT FILLING SINGLE DIRECTION VALVE

- Compact design structure and reliable locking position without much more modification on the current engine interfaces; especially valve core’s sealing well guarantee of oxidant filling single direction valve after locking close up.;

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-4 THE VACUUM INTEGRITY STUDY OF INSULATION MATERIAL ON THE TANK OF LOW TEMPERATURE ROCKET

- Mechanism research of insulation material breaking up regarding low temperature propellant;
- the methods studying of low temperature propellant tank's insulation material and ground verification tests;
- The technique method studying of CZ-3 series rockets regarding preventing low temperature propellant tank's insulation material breakup.

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-5 THE DE-ORBIT MEASURE STUDYING AND ENGINEERING APPLICATION TO LEO SATELLITE AFTER MISSIONS

- Selecting the end of life satellites higher than 700Km;
- De-orbit maneuver study to satellites regarding beyond 25 years of total life in orbit.

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-6 THE DE-ORBIT CONTROLLING MEASURE STUDYING AND ENGINEERING APPLICATION TO ROCKET'S UPPER- STAGE AFTER MISSIONS

- Orbital life controlling technique investigation regarding the rocket's upper stage,
- Selecting the upper stage and implementing the maneuver to de-orbit regarding those beyond 25 years in orbit after the mission.

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-7 THE EVALUATION SYSTEM AND MITIGATION DESIGN ON SPACE DEBRIS

- Upgrading the “space debris mitigation design integrated system” to “space debris mitigation design expert system”;

3. RESEARCH ACTIVITIES FOR "12TH 5-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-8 THE EVALUATION AND EXPENSE EFFICIENCY ANALYSIS ON SPACE DEBRIS MITIGATION

- Carrying out the consequence analysis of space debris environment improvement after implementing space debris's mitigation adopted in China
- Developing the Cost-efficiency analysis of space debris mitigation activity.

3. RESEARCH ACTIVITIES FOR "12TH FIVE-YEAR PLAN FOR SPACE DEBRIS RESEARCH"

TASK-9 CHINA MITIGATION DESIGN HANDBOOK

TASK-10 THE SPACECRAFT MITIGATION DESIGN VALUATION MANAGEMENT AND TECHNOLOGY STANDARD SERIES

4. CONCLUDING REMARKS

With the support of "11th Five-Year Plan for Space Debris Research", some progress has been made in relevant field of studies in China. In the "12th Five-Year Plan for Space Debris Research", China will put greater effort for space debris mitigation research, including mitigation measures for new launching vehicles, engineering application for satellite passivation and de-orbiting, space policy studies for mitigation and so on. China will also continue to enhance the collaboration with other countries, and to protect the space environment.

Thank you for your attention!