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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

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Design requirements for residual propellant venting of launch vehicles

运载火箭剩余推进剂排放设计要求

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Foreword

This standard is drafted in accordance with the rules given in GB/T 1.1-2009. This standard is proposed by China Aerospace Science and Technology Corporation. This standard is nationalized by the National Aeronautical Technology and Its Application Standardization Technical Committee (SAC/TC425). The drafting of this standard. China Aerospace Science and Technology Corporation Shanghai Aerospace Systems Engineering Research Institute. The main drafters of this standard. Gu Yanfeng, Lin Jianfeng, Tang Mingliang, Zhu Yin. Launch vehicle rocket - propellant emission design requirements

1 Scope

China's national design requirements for venting the residual propellant of a launch vehicle. It specifies the design criteria for residual propellant venting from the final stage, the options for how it is done, the detailed design requirements and the performance evaluation, and it applies to the venting design of final stages using room temperature liquid propellants and cryogenic liquid propellants; the handling of residual propellant on upper stages generally may take it as a reference. The requirement exists because of what happens to a spent upper stage. When the stage has released its payload it remains in orbit, and it still contains propellant - the unusable residual left in the tanks and lines, plus the pressurant that fed them. That combination is an energy source in a sealed vessel, and over months or years the tank is heated by the sun, the pressure rises, the residuals may react, and the stage explodes. Explosions of spent upper stages are historically one of the two largest sources of orbital debris, and a single one can produce hundreds of trackable fragments in an orbit crossed by working satellites. Venting the residuals deliberately, under control and immediately after the mission, removes the stored energy and prevents the event. That is why the standard's only normative reference is ISO 24113, the international space debris mitigation requirements. Doing it safely introduces its own problems, which is what the detailed design requirements address: venting produces thrust, so it changes the stage's trajectory and can bring it back towards the payload it has just released, and the plume of vented propellant can reach the spacecraft and contaminate it. The standard therefore defines the separation distance between vehicle and spacecraft, and the plume angle, as design quantities. Issued on 31 December 2015 and in force since 1 July 2016.

This standard specifies the general design requirements for the design criteria and emission options for the remaining propellant emissions of the last launch vehicle in flight. Fine design requirements and performance evaluation and so on. This standard applies to the use of room temperature liquid propellant and cryogenic liquid propellant carrier rocket final propellant discharge design, The rocket above the level of the remaining propellant processing related design can refer to the implementation.

2 Normative reference documents

The following documents are indispensable for the application of this document. For dated references, only the dated edition applies to this article Pieces. For undated references, the latest edition (including all modifications) applies to this document.

ISO 24113..2011 Space debris mitigation requirements (Spacesystems-Spacedebrismitigationrequirements)

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 Residual propellant discharge residual brelantventing Carrying the final stage of the carrier after the completion of the task, the safe release of its own tanks and pipelines within the remaining propellant process.

3.2 Residual propellant discharge system residualpropelantventingsystem The final stage of the launch vehicle is used to implement the system of its own tank and the remaining propellant discharge in the pipeline. The system is Arrow on both the system extension.

3.3 Arrow distance from spacecraft/launch-illuminated Spacecraft and the carrier after the final separation, the minimum relative distance between the two.

3.4 Plume angle angleofplume The angle between the envelope tangent and the nozzle centerline formed by the lower end of the carrier rocket or its combustion products.

3.5 The amount of amountofencounter During the discharge of the final propellant of the launch vehicle, the quality of the pollutants discharged from the surface area of the spacecraft.

3.6 Space debris mitigation spacedebrismitigation Through the reduction and control of space debris generated by the way and measures to ease the growth trend of space debris.