
Launch Collision Avoidance (LCOLA) Survey – Interim Results (updated)

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1. Outline of survey

- At the spring meeting 2019, a survey for current practice of LCOLA in each country was proposed and approved at the joint session of WG3/WG7.
- Responses were received from the following countries and organizations. **Still awaiting response from Russia.**
 - ESA
 - Ukraine (Yuzhnoye)
 - UK (UK SA)
 - India (ISRO)
 - France (CNES)
 - US (USAF, FAA, NASA, **MDA**)
 - China (CNSA)
 - Japan (JAXA)

1. Outline of survey

Launch Collision Avoidance (LCOLA) Survey

Information requested for Launch Collision Avoidance (LCOLA) NWIP, per WG3/WG7 joint session at BSI London meeting, 11 Jun 2019.

Attribute	Japan (Example)	Your country/agency/operator
Specific name of country/agency/operator:	Japan (JAXA)	[Unique country/agency/operator name]
Screened objects	All launch vehicle upper stage(s), deployed payloads and associated deployment devices (if any) that reach altitudes above 150 km are screened against human-inhabited or human-habitable spacecraft.	[Please describe the screened space objects for LCOLA]
Safety LCOLA	Pre-launch evaluation is conducted at t-24 hours (typically) covering the first 60 hours of flight, using a screening criterion based upon a miss distance 200 km radius sphere sliced at +/- 50 km . If insufficient launch window opportunities exist based upon this screening, then additional launch opportunities are sought by adjudicating these LCOLA violations using a collision probability threshold of 1×10^{-6}	[Please describe whether a Safety LCOLA is performed to mitigate the risk of launch-induced collision with human-inhabited or habitable spacecraft. If performed, please provide a detailed description of the flight timespan analyzed and the specific screening criteria used for Safety LCOLA]
Mission Assurance LCOLA	Not Performed	[Please describe whether a Mission Assurance LCOLA is performed to minimize the risk of launch-induced collision leading to loss of mission for launch system components, deployed payloads and/or other on-orbit active spacecraft. If performed, please provide a detailed description of the flight timespan analyzed and the specific screening criteria used for Mission Assurance LCOLA]

1. Outline of survey

- Responses from India, France, the U.S. and China are comparable to those from Japan.
- The response from ESA concerns the COLA of the ESA mission spacecraft, not launcher.
- The U.K. is in the process of developing launch capabilities and its LCOLA approach is not yet used in practice.

2. Survey results summary

Following information gathered in this survey.

- (1) Organization performing analysis
- (2) Screened objects
- (3) Safety LCOLA
- (4) Mission Assurance LCOLA
- (5) Orbit data source(s)

(1) Organization performing analysis

Space agencies or air force perform LCOLA analysis.

- Japan: JAXA (under contract from LSP)
- France: LSP (analysis conducted by CNES)
- The U.S. :
 - 18th Space Control Squadron
 - **Missile Defense Agency**
 - **Aerospace Co.**
 - **Others: (commercial)**
- India: ISRO
- China: CNSA Space Debris Observation and Data Application Center(SDODAC)

(2) Screened objects

- The target launch object is the launch vehicle orbital stage(s), associated deployment devices and deployed payloads.
- Objects in orbit are depend on whether this is a Safety or MA LCOLA:
 - Japan, Ukraine, France and US : human-inhabited and human-inhabitable spacecraft
 - India, China and US (defense) : All objects in catalogs
- Regarding the altitude of the launched object, Japan, the U.S. (USAF/NASA), Ukraine and China require all launched object that reach altitude above 150 km are screened.

(3) Safety LCOLA

- The following results show that major launching countries and organizations are implementing LCOLA for human-inhabited and human-inhabitable spacecraft (Safety LCOLA)
- Safety LCOLA Screening Thresholds are shown in next page.

Safety LCOLA Screening Thresholds

Criteria:	Japan	France	India	China	US FAA	US NASA	US MDA	US DoD	Russia
Objects screened	LVOS(s), associated deployment devices and deployed payloads	not mentioned	All LVOS(s) and deployed payloads	All launched payloads	All LV, any jettisoned components, and its payload	LVOS(s), associated deployment devices and deployed payloads	All launched objects to include booster sections, payload, and jettisoned components	All LV and jettisoned components	
Altitude	>150 km	not mentioned	not mentioned	>150 km	not mentioned	not mentioned	>150 km	>150 km	
Duration	60 hours	3 days	first one orbit	>first 3 orbits	>100 minutes	> 3 hours	not mentioned	first 3 hours	
Miss Distance	>200 km radius sphere sliced at +/- 50 km	-	-	<100 km radius sphere	>200km radius spherical	>200km radius spherical >An ellipsoidal 200km in-track, 50 km cross-track or radially	>200km radius spherical >An ellipsoidal 200km in-track, 50 km cross-track or radially	>200km radius spherical >An ellipsoidal 200km in-track, 50 km cross-track or radially	
Collision Probability	$<1 \times 10^{-6}$	< a specific majored probability	<pre-defined threshold value	$<1 \times 10^{-6}$	not mentioned	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	$<1 \times 10^{-6}$	

(4) Mission Assurance LCOLA

- Unmanned space object (mission assurance) LCOLA:
 - Performed in US (for defense missions).
 - In US, all conjunctions with a calculated probability of 1×10^{-7} or greater are reported to LSP.
 - India performs mission assurance LCOLA for all catalogued objects for one orbit after injection for the payloads.
 - China performs mission assurance LCOLA for all catalogued objects for at least 3 orbits.
 - Normally not performed by Japan, Ukraine, France.

(5) Orbit data source(s)

- Predominant LCOLA on-orbit population data source for countries and agencies is USSTRATCOM/18SPCS data (Space-Track).
 - Some use TLEs, some use ephemerides
- China also uses orbit data from CNSA Space Debris Observation and Data Application Center(SDODAC).

3. Next step

- To continue survey and complete with responses from at least Russia [by the end of ~~December 2019~~ ??? 2020]
- To prepare TR NWIP including WD by next ~~spring~~ fall meeting.