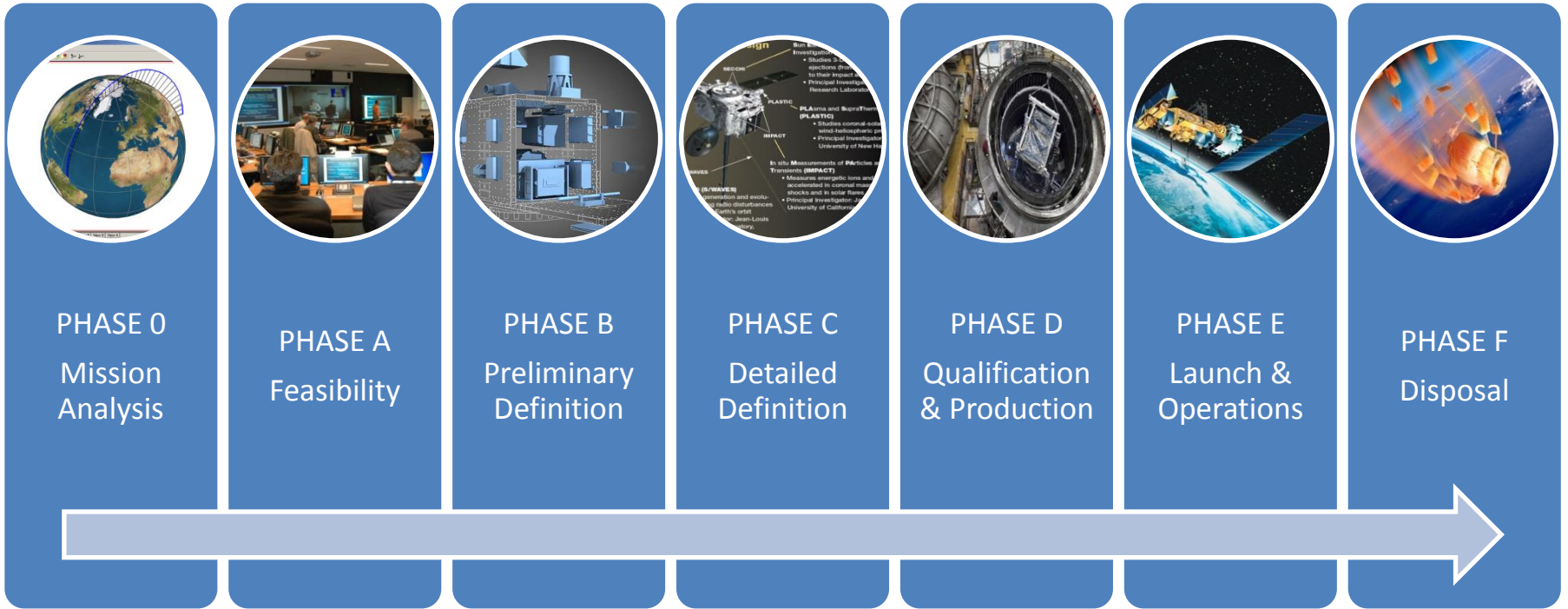


Dealing with Cubesats within the UK's Outer Space Act

Prof Richard Crowther

Chief Engineer, UK Space Agency



Preliminary Design Review (PDR)

Critical Design Review (CDR)

Flight Readiness Review (FRR)

OUTER SPACE ACT LICENSING PROCESS

Pre-Application Consultation

Application Submission

Analysis of Data Provided

Licencing Decision

Compliance Monitoring

OSA LICENSING CONSIDERATIONS

WHO?

WHY?

WHEN?

HOW?

WHAT?

WHERE?

PRIMARY ELEMENTS OF OPERATIONAL RISK



HOW?

WHAT?

WHERE?

PRIMARY ELEMENTS OF OPERATIONAL RISK

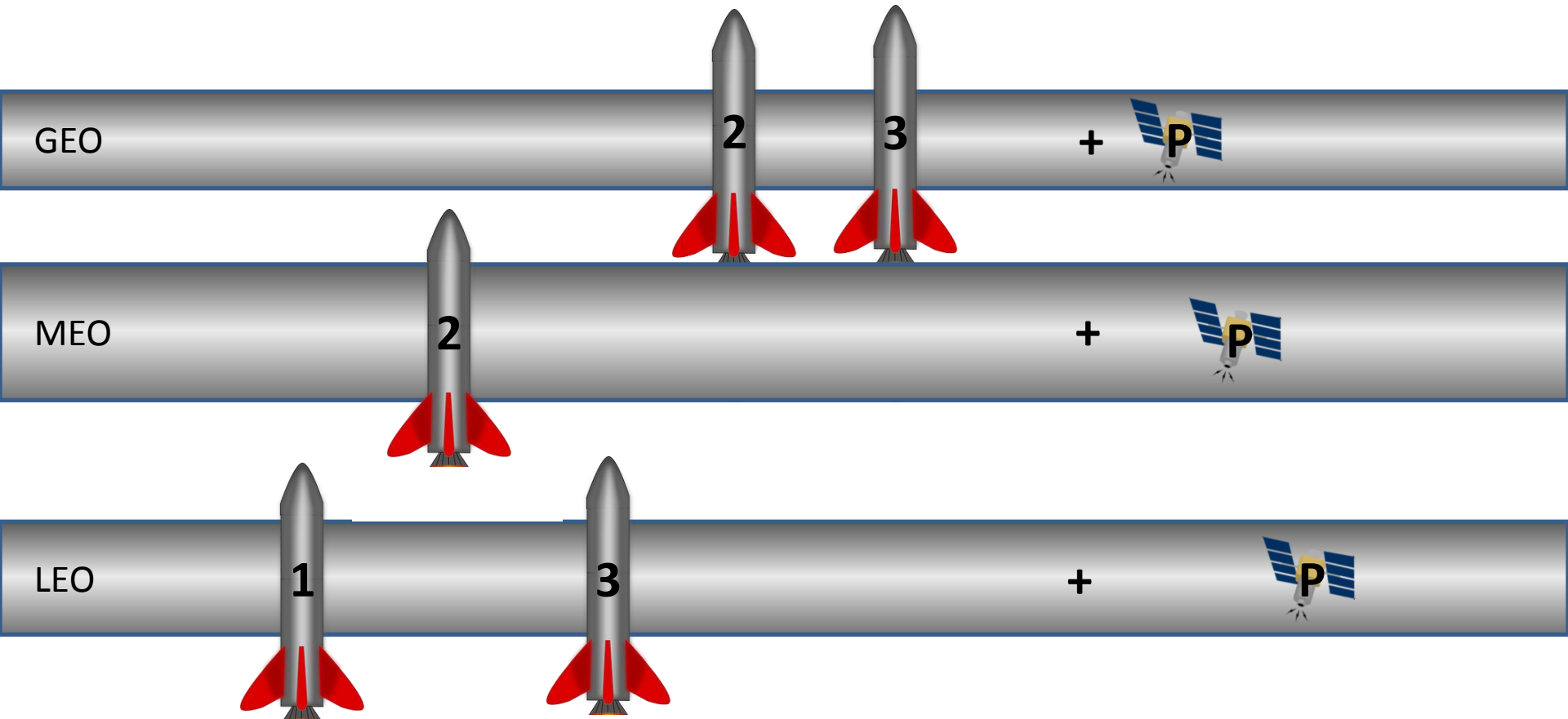


LAUNCHER

PLATFORM/
PAYLOAD

OPERATING/
DISPOSAL
ORBIT

TECHNICAL ASSESSMENT STREAMLINING



- 1: PRIMARY LAUNCH ASSESSMENT (BASELINE)
- 2: SECONDARY LAUNCH ASSESSMENT (DELTA)
- 3: TERTIARY LAUNCH ASSESSMENT (EXACT REPEAT)
- P: PAYLOAD ASSESSMENT (IN-ORBIT)



| INFORMATION REQUIREMENTS OVERVIEW | 1 | 2 | 3 | P |
|--|---|---|---|---|
| Launch system description (including functionality, performance and operating characteristics) | ✓ | | | |
| Organisational Roles, Responsibilities and Authorities | ✓ | | | |
| Safety Processes and Procedures for Launch Operation | ✓ | | | |
| Flight Vehicle and Flight Safety System General Design and Qualification/Acceptance Testing (including historical and predicted reliability) | ✓ | | | |
| Accident Investigation Outcomes | ✓ | | | |
| General Mission Description | ✓ | ✓ | | |
| Trajectory Information and Impact Points (to include launch trajectory and azimuth; ground track and land mass over-flight; sequence of major events; nominal impact locations; parking, operational and disposal orbits; operations; flight termination criteria) | ✓ | ✓ | | |
| Risk Assessment to include Failure Analysis, Consequence Estimation, Risk Management approach and Safety Implementation | ✓ | ✓ | | |
| Departures from primary baseline information submissions | | ✓ | | |

PRIMARY ELEMENTS OF OPERATIONAL RISK



LAUNCHER

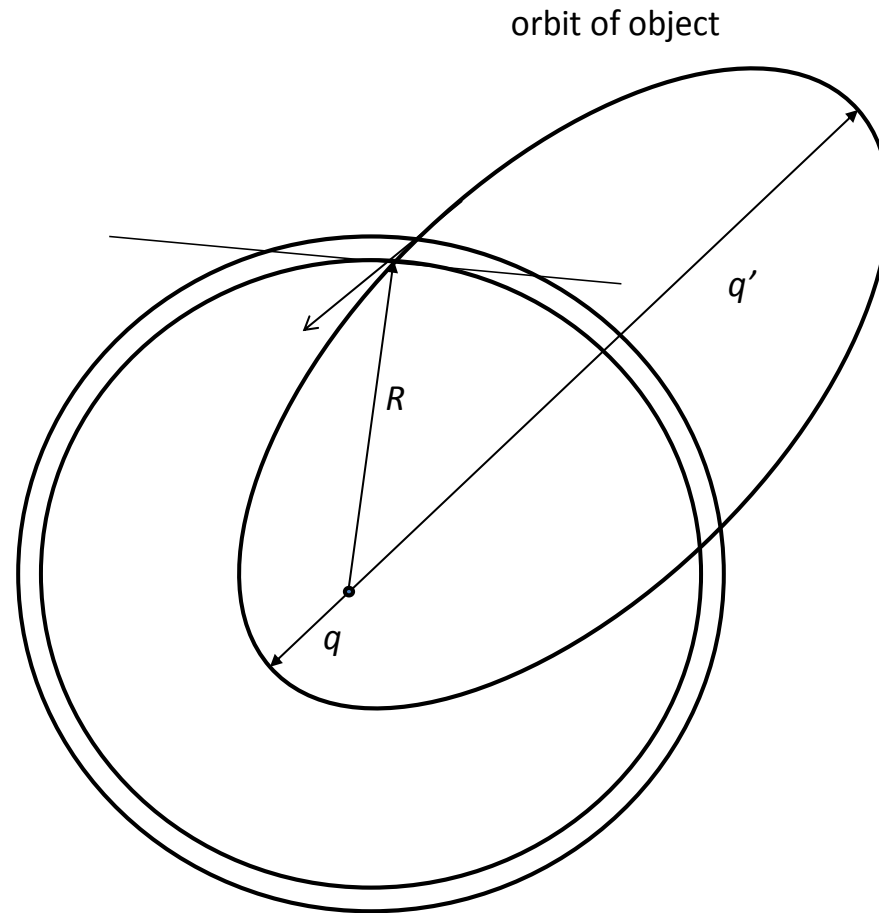
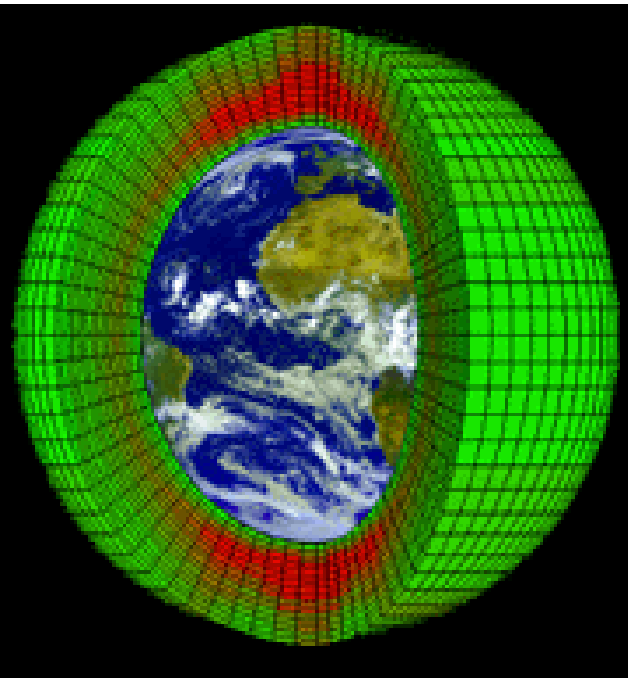
PLATFORM/
PAYLOAD

OPERATING/
DISPOSAL
ORBIT

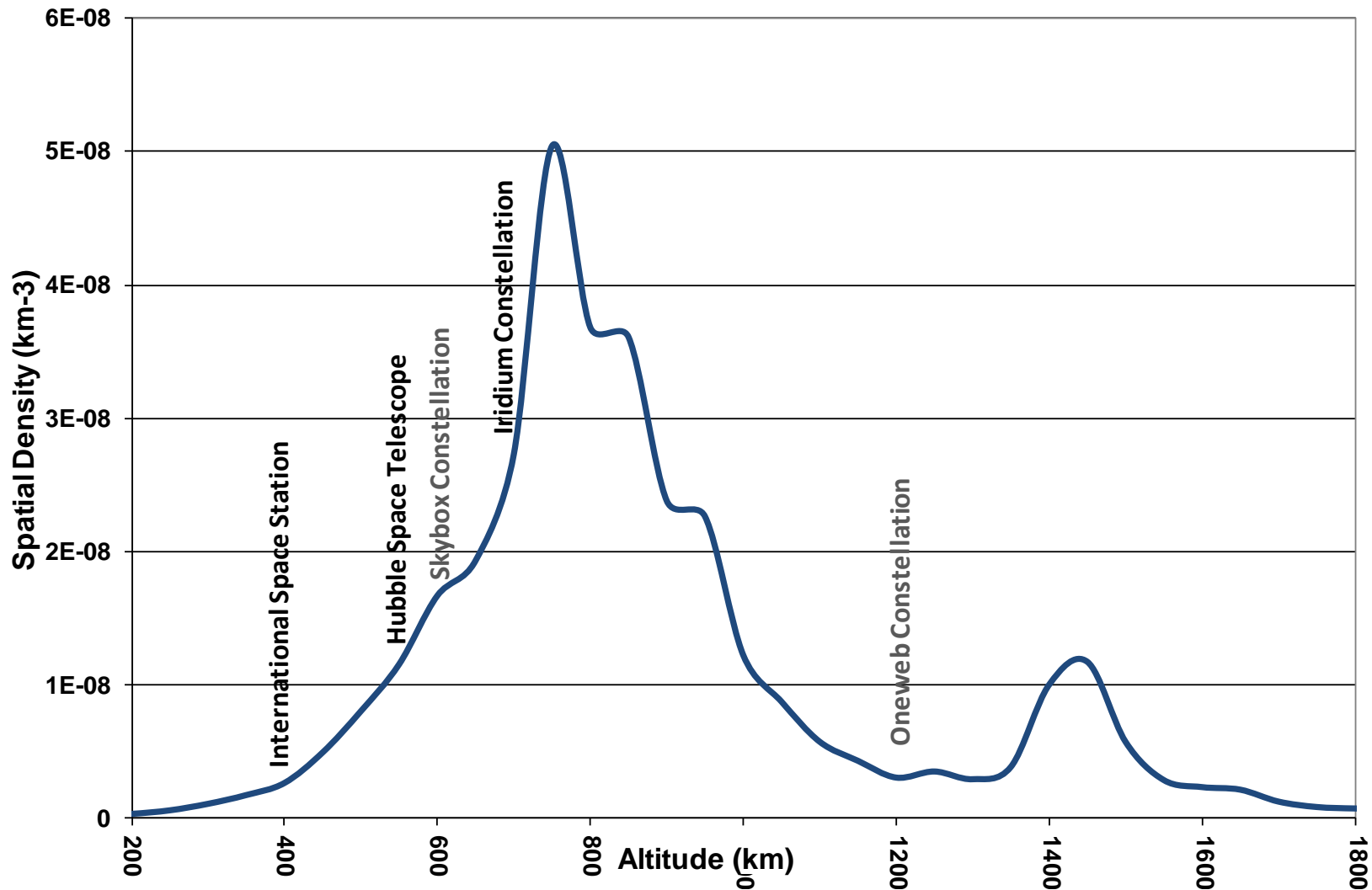
PRIMARY ELEMENTS OF OPERATIONAL RISK



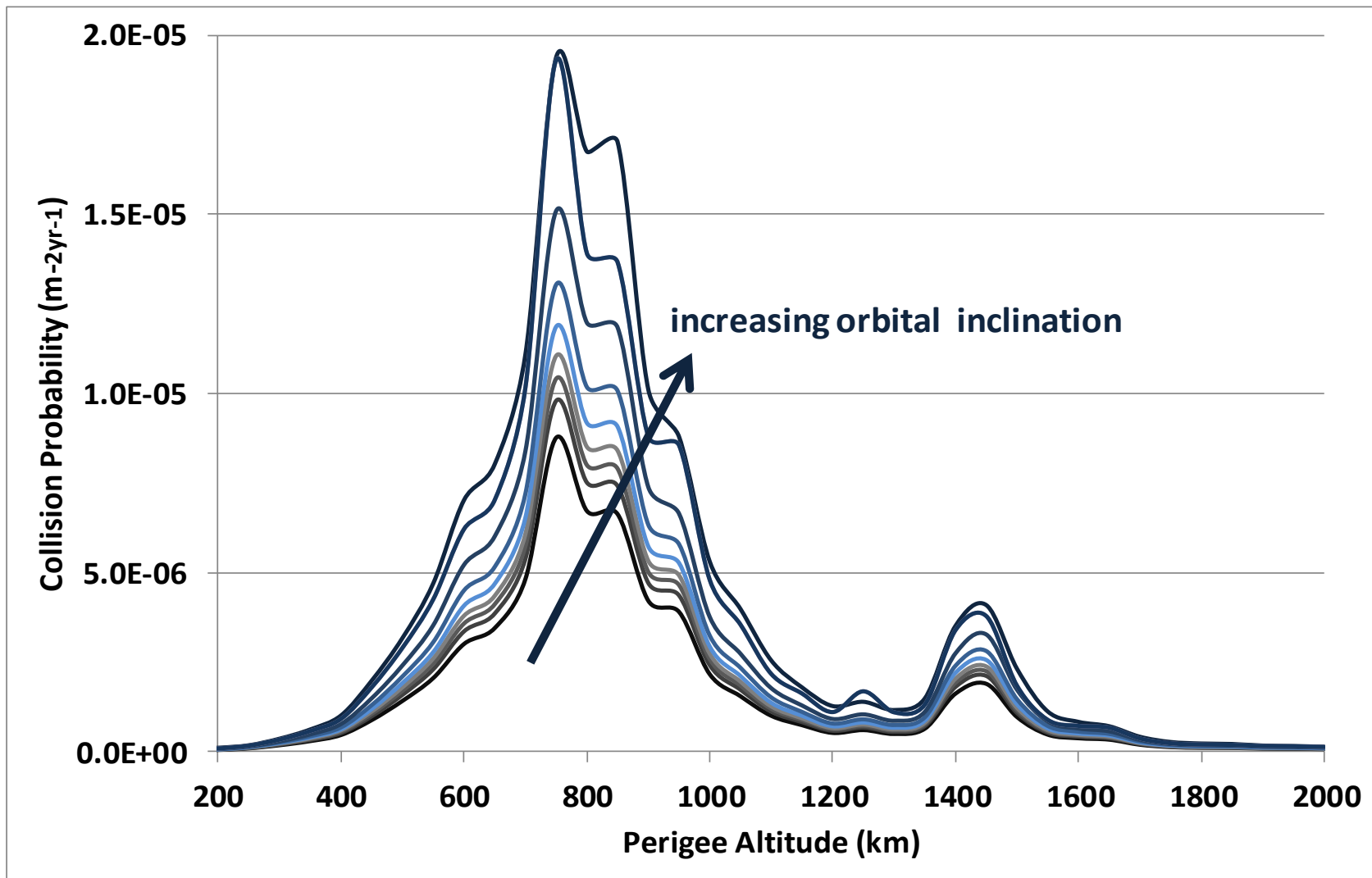
Spatial Density



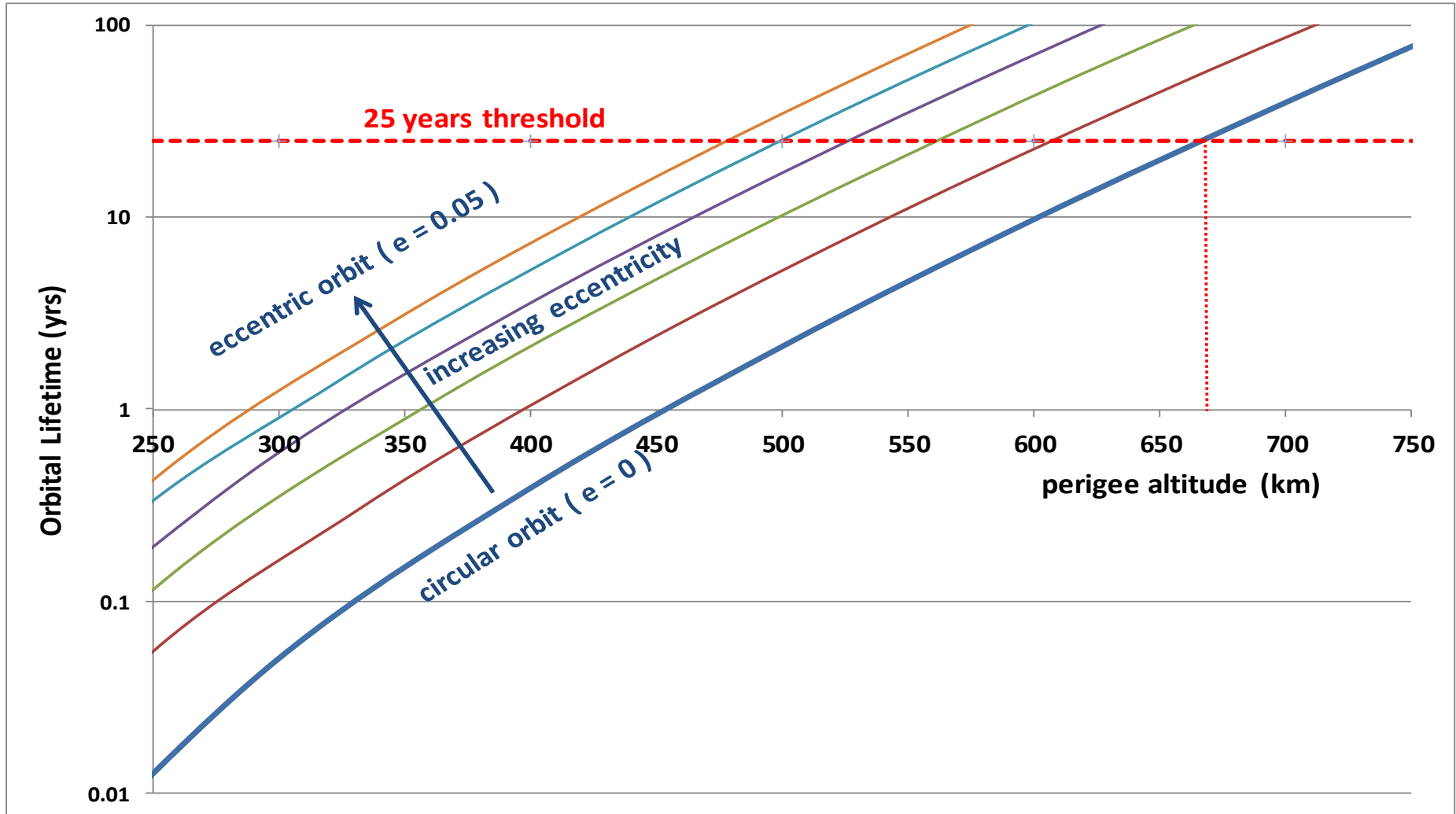
Spatial Density



Collision Probability



Orbital Lifetime



LAUNCHER

PLATFORM/
PAYLOAD

LEO satellite injected
into orbit \gg 25 yrs,
no deorbit system

LEO satellite injected
orbit $>$ 25 yrs with
deorbit system

LEO satellite injected
into orbit less than 25
years

MANAGING GENERAL RISK



THIRD PARTY LIABILITY

INSURANCE COVER

INFORMED TECHNICAL ASSESSMENT

SYSTEM INFORMATION REQUIREMENTS

OVERSIGHT AND COMPLIANCE MONITORING

RISKS MOVE FROM OPERATOR TO REGULATOR

MANAGING CUBESAT RISK



THIRD PARTY LIABILITY

LIMITED EXPOSURE TO LIABILITY



REDUCED INSURANCE COVER



REDUCED TECHNICAL ASSESSMENT

PRE-DETERMINED ANALYSES



REDUCED SYSTEM INFORMATION

USE OF STANDARD MODELS



REDUCED COMPLIANCE MONITORING

STATUS/ HEALTH REPORTING



RISKS AND BURDEN BALANCED



COSTS TO OPERATOR AND REGULATOR REDUCED



LAUNCHER

PLATFORM/
PAYLOAD

OPERATING/
DISPOSAL
ORBIT

```
graph LR; A[Cubesat ejection from dispenser on ISS] --> B[Platform conforms to Cubesat standard]; B --> C[Cubesat injected into orbit < 25 years];
```

Cubesat
ejection from
dispenser on
ISS

Platform
conforms to
Cubesat
standard

Cubesat
injected into
orbit < 25 years