

Time Maps of Human Spaceflight: 1956-1958

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The conventional Gantt schedule chart is designed primarily for the purpose of displaying the current planning of activities on a program. It is not well suited to depicting the ebb and flow of events in the life of a program as a variety of forces influence the project over time. In reality, such a chart contains only one dimension of time: that momentary vision of the future that exists in the collective mind of the program management. By adding a dimension—that of historical time—the evolution of management's view of the future can be displayed. Furthermore, in this new two-dimensional environment, important trend information becomes visible and quantifiable for the first time, enabling managers to make better-informed judgments concerning the credibility of the current program schedule. The two-dimensional time format liberates us from the conventional perception of time as being linear and unidirectional, and allows us to see time in its two distinct components. One axis of time is the past—the domain of deeds already done. The other element of time is the future, which exists in the separate dimension of human imagination and planning. Together they form the surface of time, and it is only on this two-dimensional surface that our journey between the past and the future can be properly mapped out.

“Atlas of an Undiscovered Country” is a project to map the entire scheduling history of human spaceflight. In this paper, time maps of the scheduling history of human space missions during the 1956-1958 period are presented.

Nomenclature

⊕	=	Earth
♂	=	Mars
IOC	=	Initial Operational Capability
MA	=	Mercury Atlas
MISS	=	Man in Space Soonest
MOI	=	Mars Orbit Insertion
MOL	=	Manned Orbiting Laboratory
MPK	=	Марсианской Пилотируемых Комплекс (Martian Piloted Complex)
MSTO	=	Mars Surface Takeoff
STS	=	Space Transportation System
TEI	=	Trans-Earth Injection
TMI	=	Trans-Mars Injection

I. Introduction

Offer a toast. The undiscovered country... the future.

Chancellor Gorkon, Klingon Empire
Star Trek VI: The Undiscovered Country

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The time map methodology used in the “Atlas of an Undiscovered Country” is described in AIAA-2007-6073.¹ As of 1 July 2009, 274 human space missions have flown. Meanwhile, the Atlas project has captured approximately 22,000 data points on 4,683 manned missions and 1,387 human-related precursor and support missions. A broad-category breakdown is provided in Table 1.

An overview map of the entire research project is provided in Appendix 1. The total time area of the project is about 850 square years, and the average depth of scheduling is about 16 years. The color scheme in Appendix 1 organizes the atlas into schedule bands of eight years. It is expected that as the data becomes more complete, it will show that at nearly every point in historical time, the schedule for at least one manned space program forecasts missions out to at least 8 years in the future. Also, it is not uncommon for years to contain schedules that project out to 16 years in the future; however, almost none of the missions in the 9- to 16-year band persist long enough to enter the one- to 8-year band, much less make their way to the diagonal event horizon, where future and past meet in that fleeting moment called the present, and missions are actually launched. Often the missions beyond the first 8-year band are manned lunar and planetary missions. In particular, human missions to Mars are a persistent component of long-range planning where such planning exists at all.

This paper presents the current state of research on the scheduling history of human and human-related space missions for the years 1956-1958. A companion to this paper, presented at this same conference, covers the years 1959-1961.²

II. Discussion of the Data

Detailed maps of the data for the 1956-1958 period are provided in Appendix 2. Each spacecraft/launch vehicle combination is depicted in distinctive colors, with cool colors representing manned missions and warm colors representing unmanned missions.

A. American Programs

This period featured one United States Army and three Air Force human space programs, all in the early planning stages: Within a few months of the Soviet Union’s launching of the first satellite, and the first living organism in orbit, the Army retrieved some of America’s national prestige by launching the first US satellite. Wernher von Braun proposed to follow up this success by launching a human on the same Redstone missile by the end of 1959 in a concept called Adam.³ Although initially disparaged as a circus stunt, the concept later developed into NASA’s Mercury Redstone program. At the same time, the Air Force proposed to place a human in orbit in 1960 using an Atlas missile in concept called Man in Space Soonest (MISS), which later evolved into NASA’s Mercury Atlas program.^{4,5} According to the Air Force vision, however, MISS would soon pave the way for Lunex, a program aimed at establishing a base on the Moon.⁶ The initial MISS concept called for development of an upper stage for the Thor missile whose oxidizer would be liquid fluorine, and in May 1958 the Air Force planned to launch the first manned mission in October 1960; however, soon it was realized that development costs for such an exotic propellant system, and in June 1958 the switch was made to the Atlas missile as the MISS launch vehicle. The Air Force pulled the launch date forward to April 1960, but the prospects for funding and estimates of technical difficulty changed frequently, so that by July 1958 the launch date pushed out to July 1960, then in September 1958 the target date slipped to December 1960. The following month, NASA opened for business and assumed responsibility for putting the first Americans in space, and in December 1958 the new civilian space agency set a target date April 1960 for the first manned Mercury Atlas mission.

More data is available for Dyna-Soar in this period,^{7,8} since that Air Force program began a couple of years before Mercury.^{9,10} It can be seen that the planned dates of major Dyna-Soar milestones fluctuated by as much as 3 years. Large schedule changes are not atypical of an immature program, as tradeoffs are made between cost and performance. For instance, fluctuations of roughly 1 year can be seen in the early Constellation program. However, the schedule fluctuations in the Dyna-Soar program from August 1957 and November 1958 are unusually large, and can be understood in part as a response to the early Soviet successes in space beginning with *Sputnik 1*, that response being to rise to the challenge by accelerating the Dyna-Soar program. At this early stage of Dyna-Soar planning, individual missions are not evident, but only the dates for major phases of the program.

B. Soviet Programs

Throughout the Atlas project, data on Soviet and Russian programs is sparse, and usually scheduling information exists to a time depth of only 2 or 3 years from the event horizon, although hopefully better sources will be discovered in future research. Typical exceptions to this are sporadic long-range plans for human expeditions to Mars, and the proposed MPK project in 1956 is the first of these known.¹¹

III. Project Schedule Metrics

In future papers in this series, Table 2 will present schedule slope and schedule expansion data for programs of the period covered. In this paper, however, Table 2 is intentionally left blank, as the data captured for this embryonic period in space technology is not conducive to such analysis.

IV. Summary of Scheduled and Proposed Missions

A total of 40 missions have been identified for this period (see Table 3):

- 4 manned, launched during this period or later
- 11 manned, not launched
- 1 unmanned, launched during this period or later
- 24 unmanned, not launched

A list of these missions is given in Table 3. Flights assigned to perform a specific mission profile often change flight numbers as other missions are inserted, deleted, or resequenced. Therefore a distinct mission designation has been assigned to each mission. The last assigned mission number of the flight, the last x-date and y-date, the launch vehicle, and a brief mission description is also given. Information inferred from other data is given in red.

V. A Brief Look at Today's Future

In addition to the time maps for 1956-1958, this paper includes time maps for July 2008 through June 2009 as examples of how rich the data is in other regions of the Atlas of an Undiscovered Country. Depicted in these time maps are the last Space Shuttle missions, including a proposed extension of flight operations beyond 2010. The entire Constellation program is also shown as it have been planned during this recent 12-month period, including the resumption of human exploration of the Moon after a half-century hiatus, followed by human missions to Mars.* Throughout the Atlas project, data on Soviet/Russian and Chinese programs is sparse, and usually scheduling information exists to a depth of only two or three years from the event horizon, although hopefully better sources will be discovered in future research. The sample time maps also include the first Indian manned Earth orbital space mission and the first Indian manned lunar landing, as well as Iran's announced intention to initiate its own manned space program. The Virgin Galactic's SpaceShipTwo suborbital passenger spacecraft and Bigelow Aerospace's BA-330 space station project are also in evidence.

VI. Call for Additional Data

As research on the Atlas of an Undiscovered Country project proceeds, primary sources on historical mission scheduling data is needed for Soviet, Russian, Chinese, and commercial human space programs, as well as for the Space Shuttle program from 1980 to date. Primary sources include program office and space agency documents for government programs, and corporate documents for commercial programs.

This paper covers a period for which there is little data on the scheduling of specific human-related space missions; yet, it is here that the journey to explore the undiscovered country begins. In Appendix 1 is provided a map of the entire project. The intention is to present three papers per year, each covering a 3-year period, at AIAA symposia. At that rate, the 60-year history of human spaceflight planning will be presented in the course of the next 7 years. This paper launches that 7-year mission.

Some people think the future means the end of history. Well... we haven't run out of history quite yet.
Captain James Tiberius Kirk, United Federation of Planets
Star Trek VI: The Undiscovered Country

* The mission designation schema for the Constellation program that has been adopted in this paper mirrors that of the Apollo program: CA for Constellation Ares, with series 100 and 500 representing Ares I and Ares V missions, respectively.

Table 1. Overview of Human and Human-Related Space Missions.

Program	Total Manned	Flown Manned	Unflown Manned	Total Unmanned	Flown Unmanned	Unflown Unmanned
Vostok, Voskhod	20	8	12	12	11	1
Soyuz, L-1, L-3, Salyut, Mir, ISS	193	101	92	260	165	95
Salyut, Almaz, TKS, Mir, ISS	10	0	10	35	28	7
Other Soviet/Russian	13	0	13	44	5	39
X-20 Dyna Soar	70	0	70	18	0	18
Mercury	37	6	31	15	10	5
Gemini, MOL	66	10	56	32	10	22
Apollo, Skylab	509	15	494	423	12	411
Space Shuttle	2913	126	2787	0	0	0
Constellation	32	0	32	57	0	57
Other NASA/USAF suborbital/orbital	160	2	158	15	9	6
Other NASA/USAF lunar/planetary	138	0	138	436	0	436
Chinese	6	3	3	8	4	4
Private	510	3	507	20	2	18
European	2	0	2	7	1	6
Japanese	1	0	1	5	0	5
Indian	2	0	2	0	0	0
Iranian	1	0	1	0	0	0
Total	4683	274	4404	1387	257	1130

Table 2. Project Schedule Metrics.

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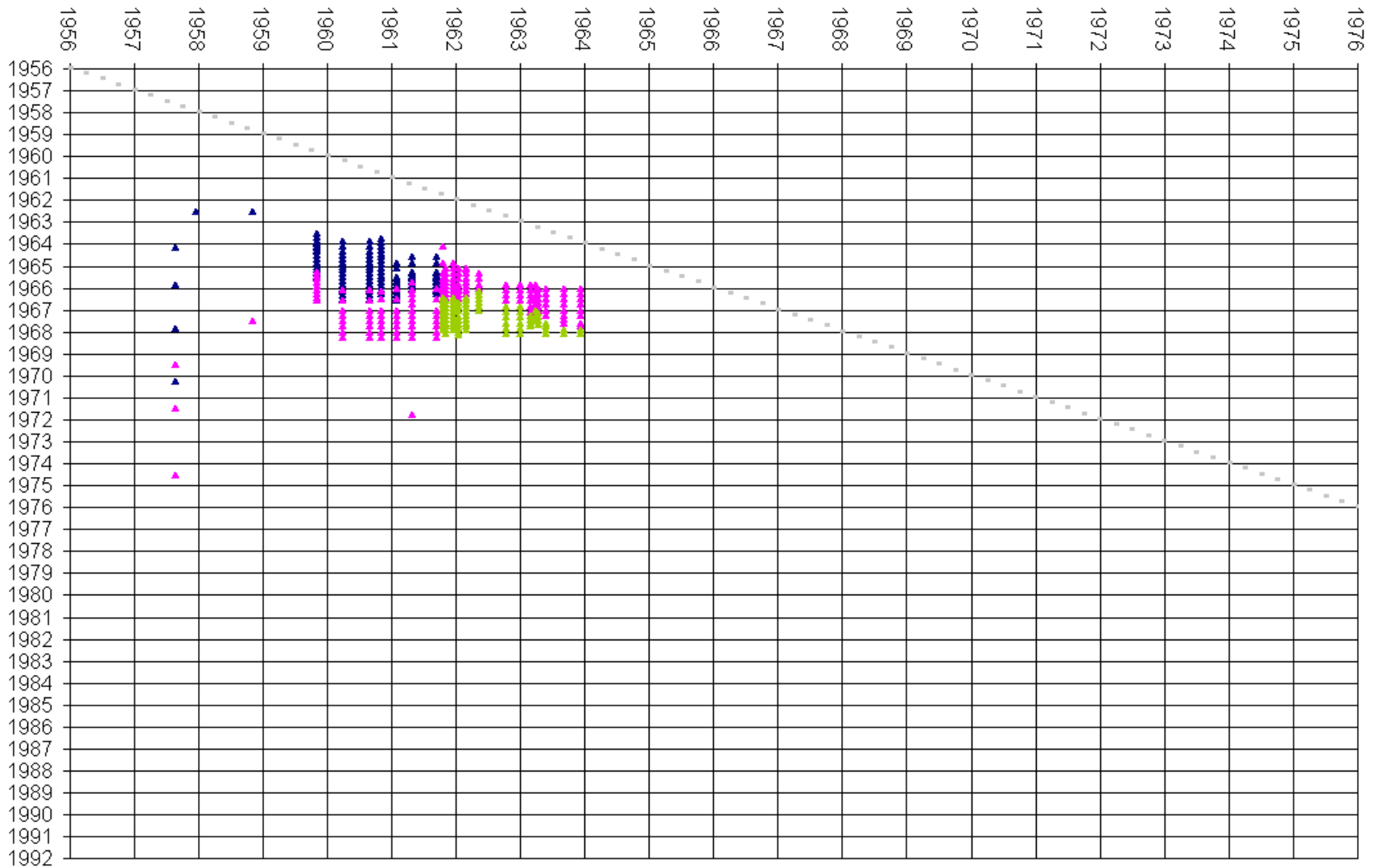


Figure 1. Dyna-Soar.

- Key:
- ▲ Suborbital
 - ▲ Short-duration low Earth orbital
 - ▲ Long-duration high Earth orbital

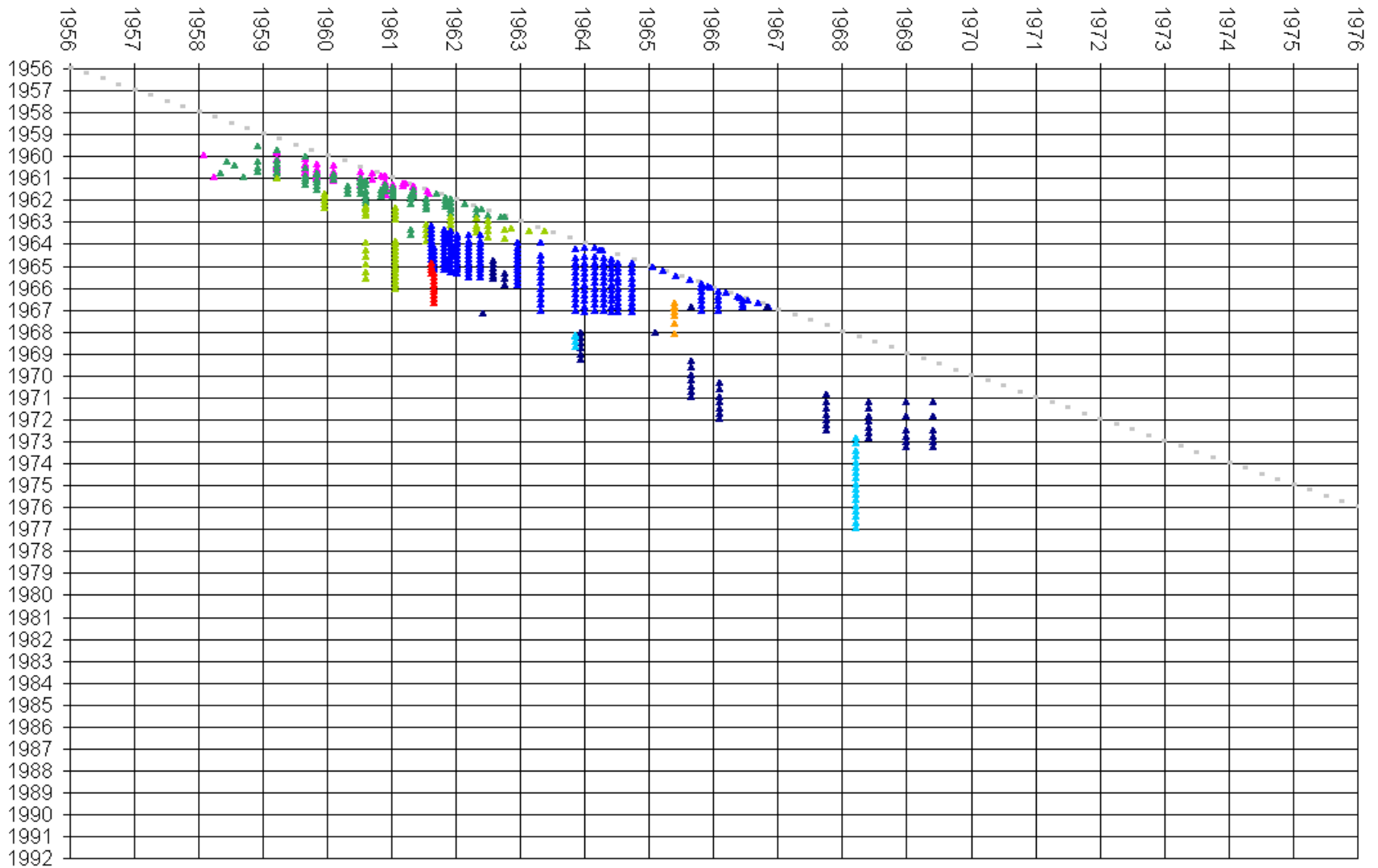


Figure 2. Mercury and Gemini.

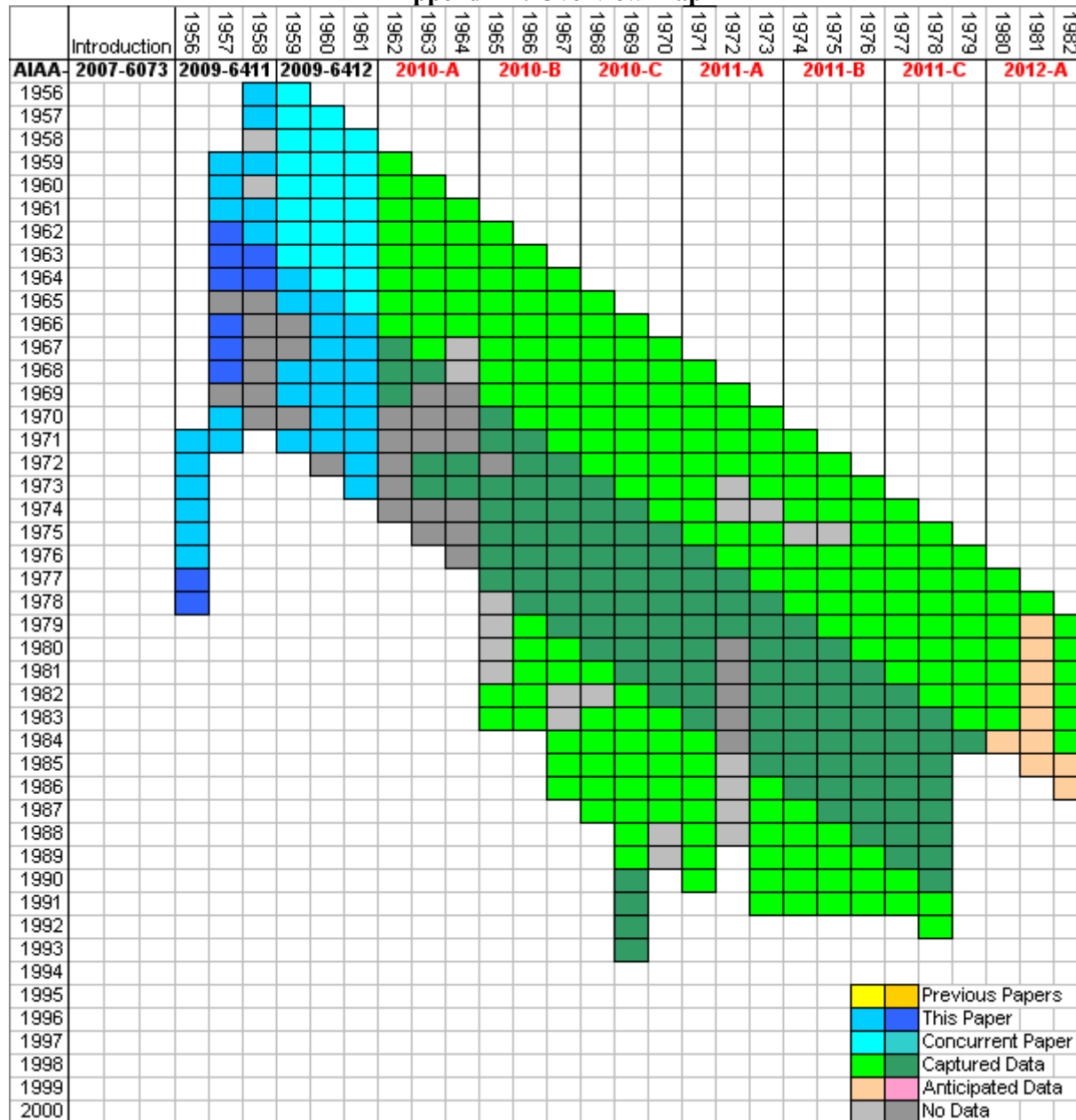
Key: ▲ Mercury Redstone and Mercury Jupiter
▲ Mercury Atlas core program
▲ Mercury Atlas expanded program

▲ Gemini core program
▲ Gemini lunar program
▲ Blue Gemini and Manned Orbiting Laboratory
▲ Gemini follow-on
▲ Enlarged Gemini space station ferry

Table 3. List of Distinct Missions.








Mission Name	Mission Designation	Last x-date	Last y-date	Launch Vehicle	Mission Description	Manned	Launched
MPK 1P-12	Mars MPK 1P-12	1 Jul 1956	18 Apr 1975	N1	MPK 1 propulsion unit 12		
MPK 1P-13	Mars MPK 1P-13	1 Jul 1956	28 Apr 1975	N1	MPK 1 propulsion unit 13		
MPK 1P-14	Mars MPK 1P-14	1 Jul 1956	8 May 1975	N1	MPK 1 propulsion unit 14		
MPK 1P-15	Mars MPK 1P-15	1 Jul 1956	18 May 1975	N1	MPK 1 propulsion unit 15		
MPK 1P-16	Mars MPK 1P-16	1 Jul 1956	28 May 1975	N1	MPK 1 propulsion unit 16		
MPK 1P-17	Mars MPK 1P-17	1 Jul 1956	7 Jun 1975	N1	MPK 1 propulsion unit 17		
MPK 1P-18	Mars MPK 1P-18	1 Jul 1956	17 Jun 1975	N1	MPK 1 propulsion unit 18		
MPK 1P-19	Mars MPK 1P-19	1 Jul 1956	27 Jun 1975	N1	MPK 1 propulsion unit 19		
MPK 1P-20	Mars MPK 1P-20	1 Jul 1956	7 Jul 1975	N1	MPK 1 propulsion unit 20		
MPK 1P-21	Mars MPK 1P-21	1 Jul 1956	17 Jul 1975	N1	MPK 1 propulsion unit 21		
MPK 1P-22	Mars MPK 1P-22	1 Jul 1956	27 Jul 1975	N1	MPK 1 propulsion unit 22		
MPK 1P-23	Mars MPK 1P-23	1 Jul 1956	6 Aug 1975	N1	MPK 1 propulsion unit 23		
MPK 1P-24	Mars MPK 1P-24	1 Jul 1956	16 Aug 1975	N1	MPK 1 propulsion unit 24		
MPK 1	Mars MPK 1	1 Jul 1956	26 Aug 1975	N1	1st manned Mars landing, MOI 10 Aug 1976, TEI 16 Jul 1977, return 12 May 1978	X	
Dyna Soar I	Dyna Soar 1S-2	23 Aug 1957	1 Nov 1965	Titan I	2nd manned suborbital on Titan I, two-stages	X	
Dyna Soar II	Dyna Soar 2S-1	23 Aug 1957	1 Nov 1967	Titan II	1st manned boosted test on Titan II	X	
Dyna Soar III	Dyna Soar CS-1	23 Aug 1957	1 Apr 1970	Titan II/Centaur	1st incomplete boost test on Titan II/Centaur	X	
Dyna Soar III	Dyna Soar CO-1	23 Aug 1957	1 Jul 1971	Titan II/Centaur	1st complete boost test on Titan II/Centaur	X	
Dyna Soar III IOC	Dyna Soar COP-1	23 Aug 1957	1 Jul 1974	Titan II/Centaur	1st operational mission on Titan II/Centaur	X	
Adam	Mercury R-1	1 Feb 1958	1 Dec 1959		1st manned suborbital	X	X
MER	Mercury MER-1	1 Apr 1958	1 Dec 1960			X	
Lunex	Lunex G-1	1 Apr 1958	1 Dec 1965	Super Titan	1st manned lunar landing	X	
Dyna Soar 3	Dyna Soar 1S-1	1 Nov 1958	1 Jul 1962	Titan I	1st manned suborbital on Titan I	X	
Dyna Soar 19	Dyna Soar 2O-1	1 Nov 1958	1 Oct 1963	Titan II	1st manned orbital on Titan II	X	
Dyna Soar II IOC	Dyna Soar 2OP-1	1 Nov 1958	1 Jul 1967	Titan II	1st operational mission on Titan II	X	
Mercury Atlas 1	Mercury A-SB	1 Dec 1958	1 Jul 1959	Atlas	Boilerplate suborbital on Atlas		X
Mercury Atlas	Mercury A-O-1	4 Dec 1958	1 Apr 1960	Atlas	1st manned short-duration orbital	X	X
Mercury Atlas	Mercury A-O-2	4 Dec 1958	1 Jul 1960	Atlas	2nd manned short-duration orbital	X	X
Mercury Atlas	Mercury A-O-3	4 Dec 1958	1 Sep 1960	Atlas	3rd manned short-duration orbital	X	X

Appendix 1: Overview Map





























Appendix 2: Detailed Maps

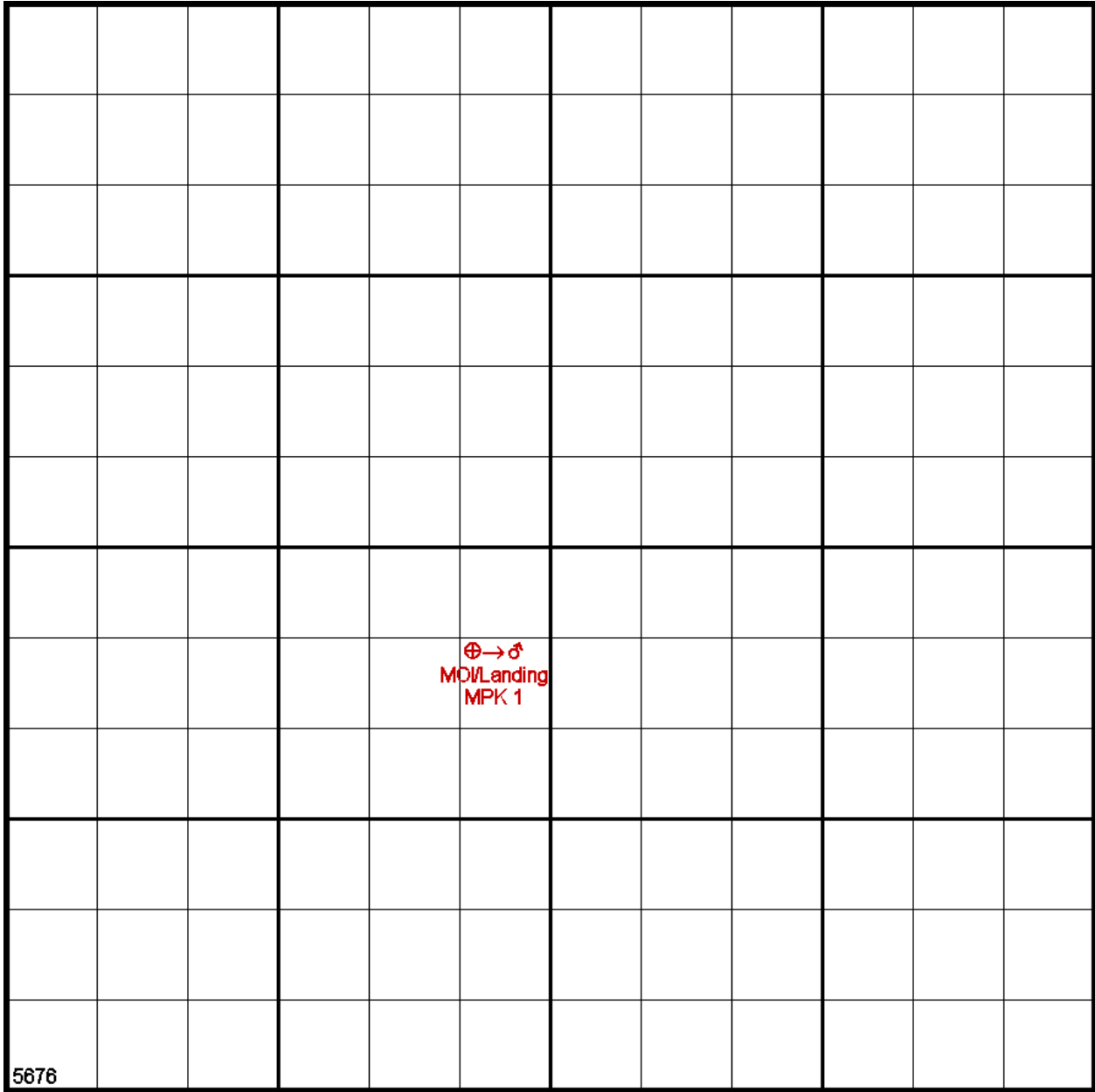
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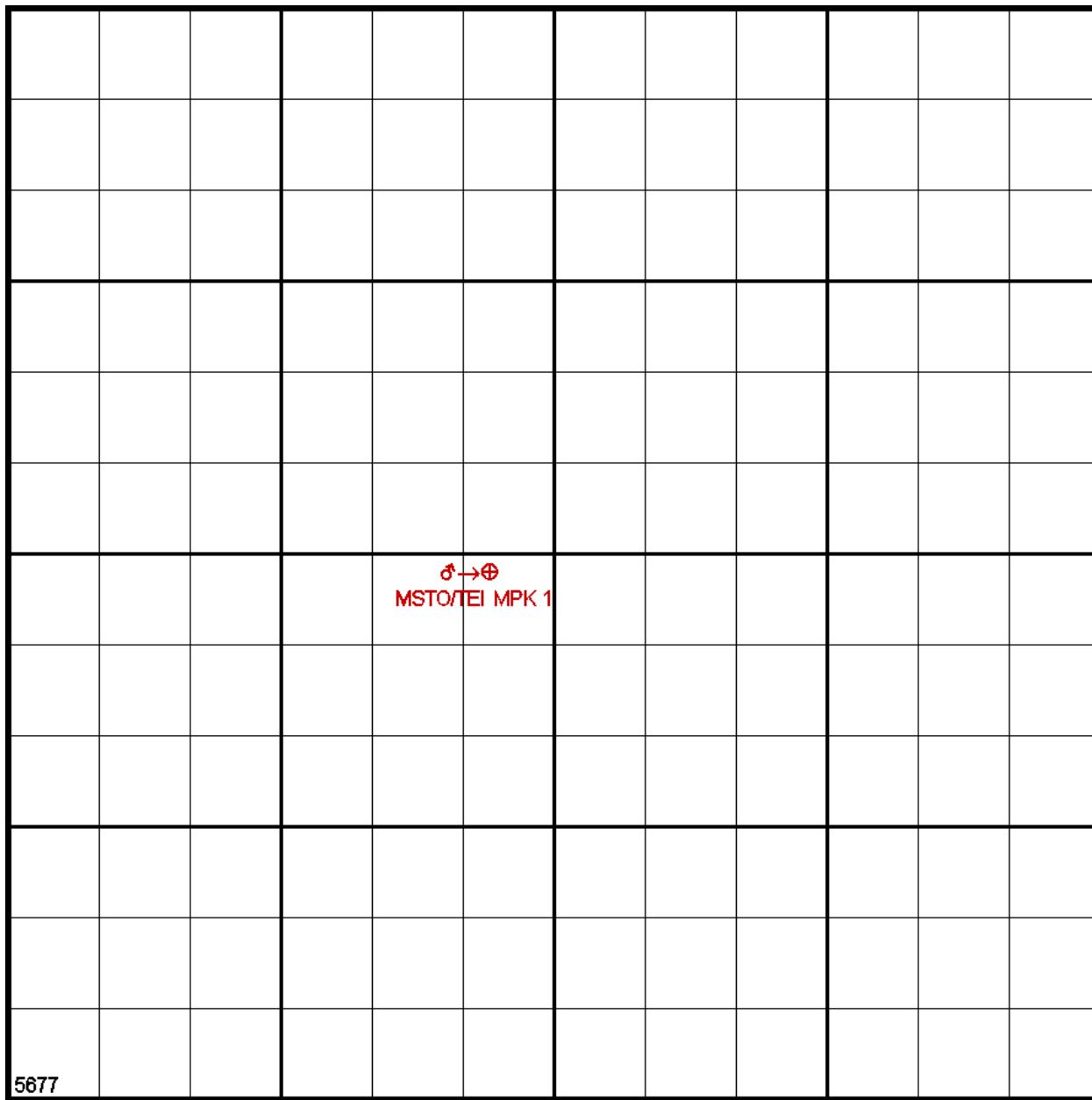
Spacecraft	Launch Vehicle	Unmanned	Manned
Mercury	Atlas		
MPK	N1		
MPK Propulsion Module	N1		
X-20 Dyna-Soar	Titan I		
X-20 Dyna-Soar	Titan II		
X-20 Dyna-Soar	Titan III		

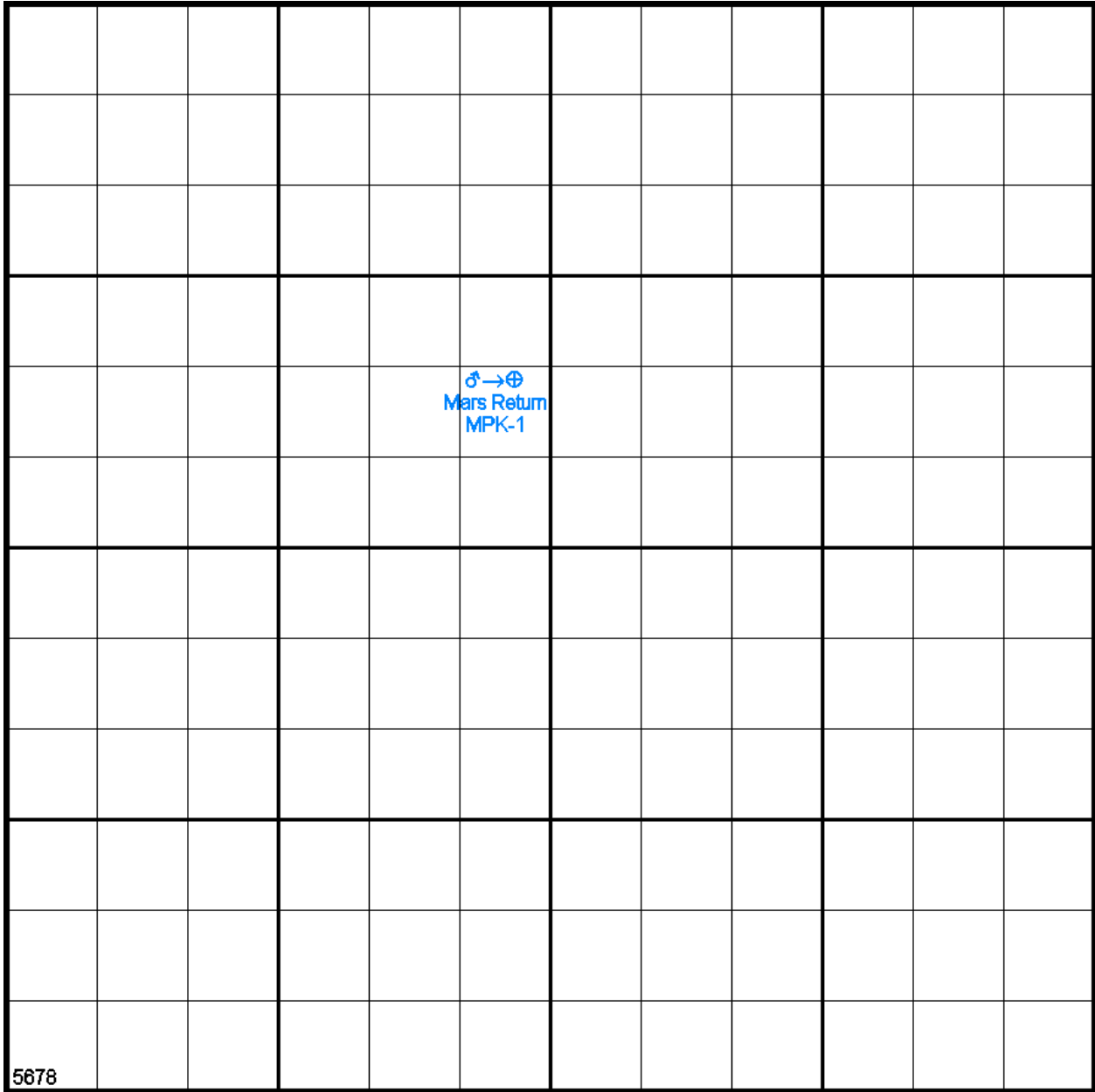
Note: The time coordinate at the bottom left of each square-year frame is in the format *xxyy*, where *xx* is the last two digits of the year in which the schedule was produced (historical time), and *yy* is last two digits of the year in which the schedule projected missions (projected time).

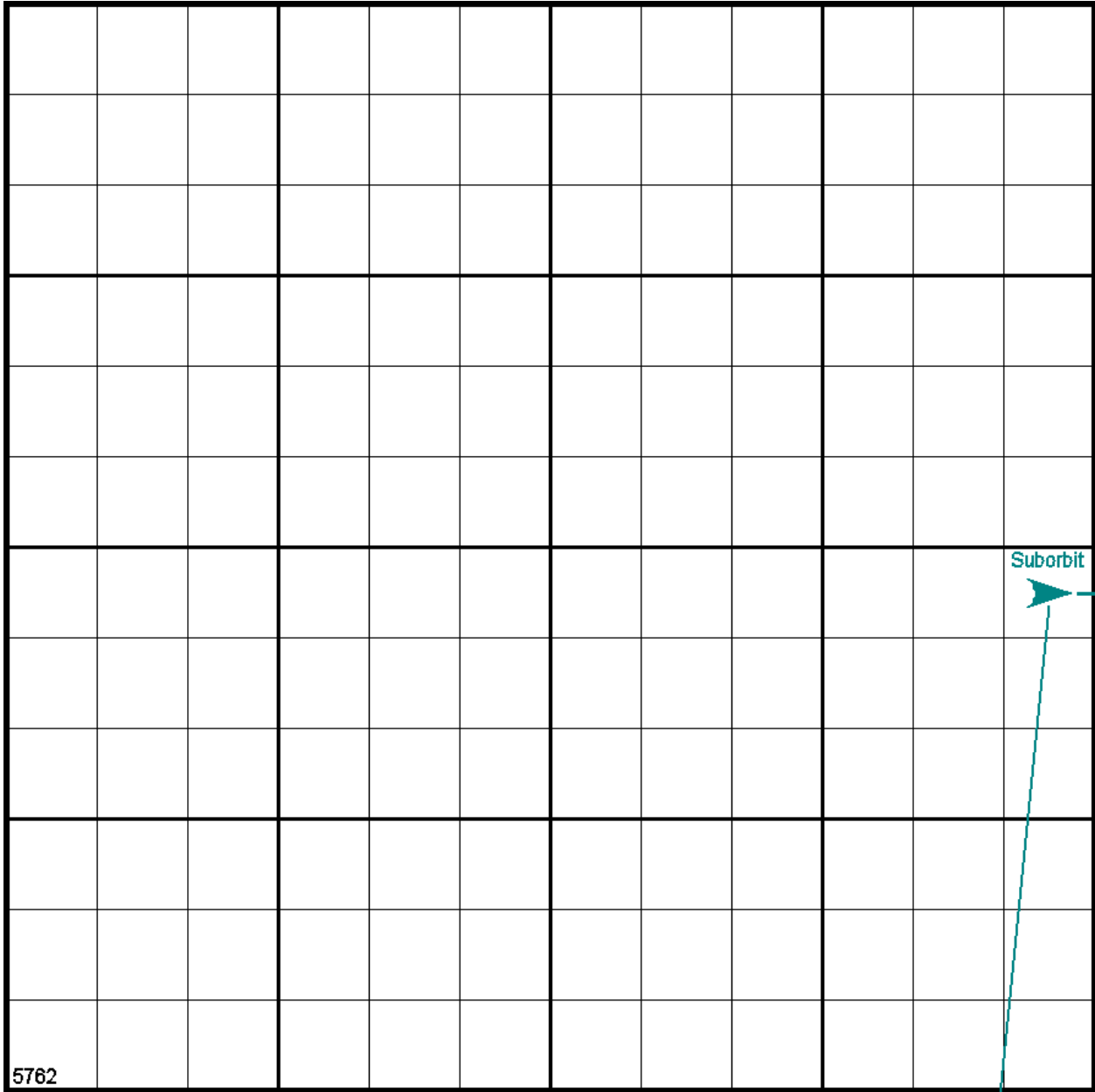
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							Propulsion MPK 1-P1				
							Propulsion MPK 1-P2				

						Propulsion	MPK 1-P3													
						Propulsion	MPK 1-P4													
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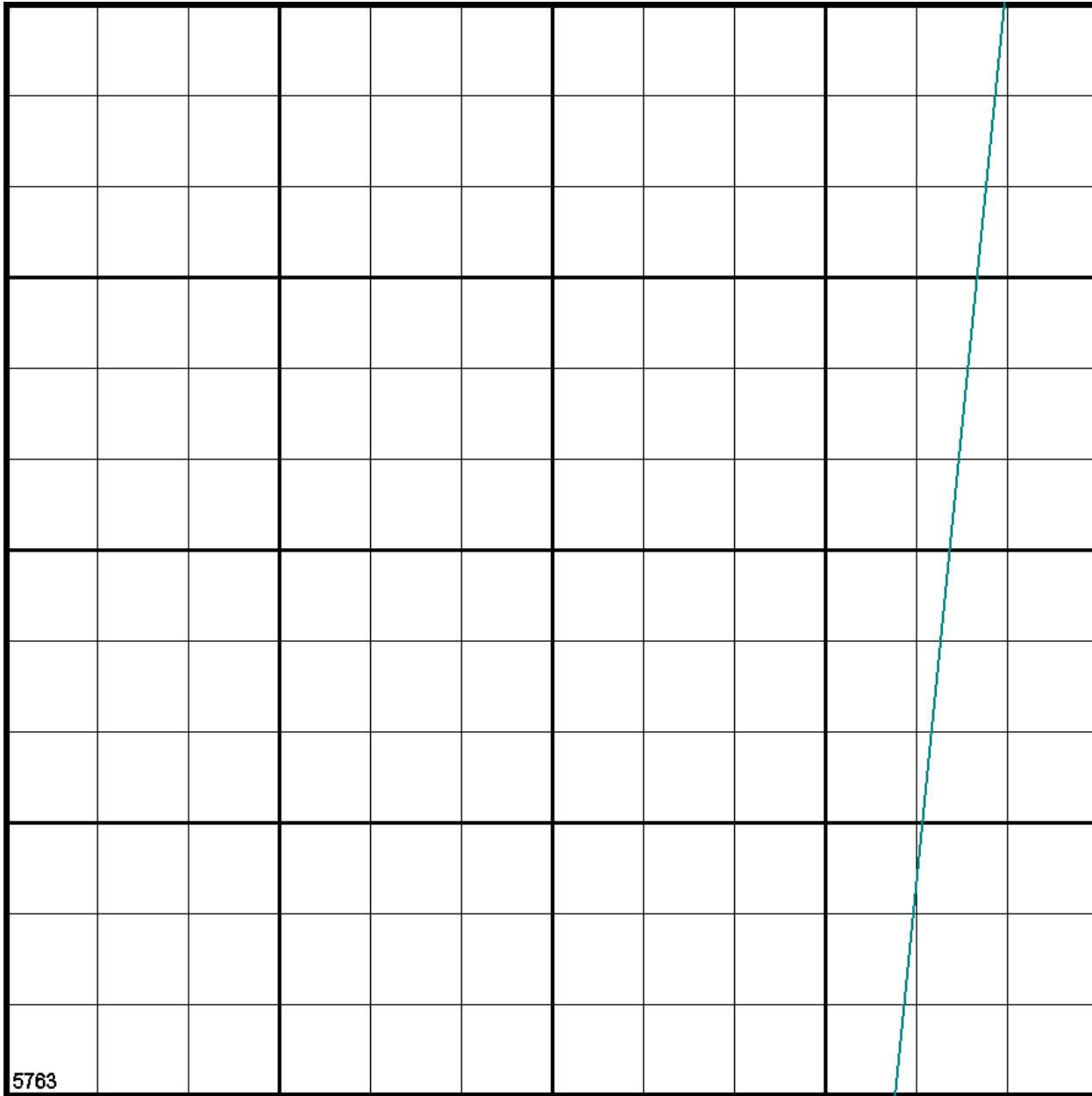




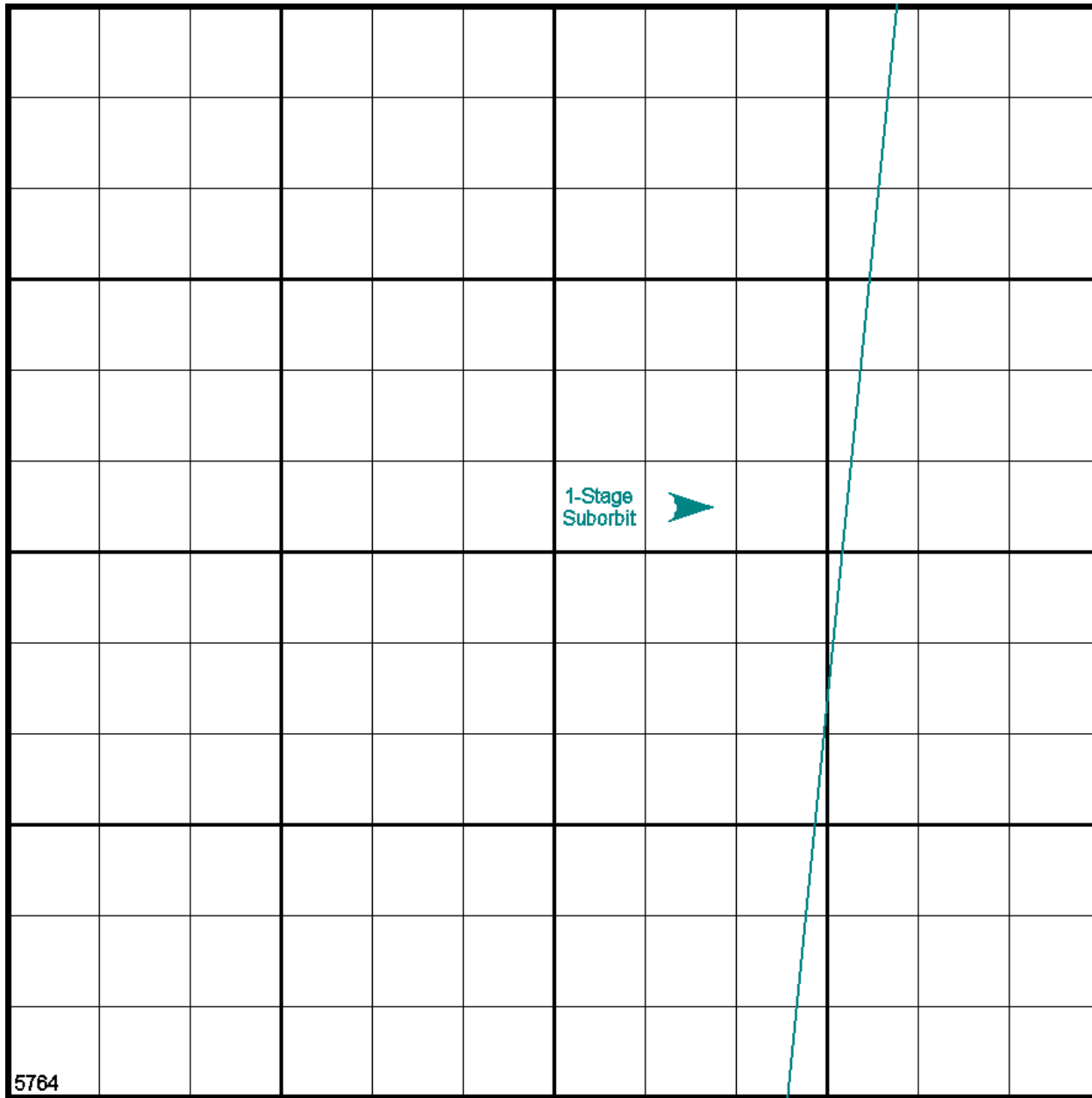


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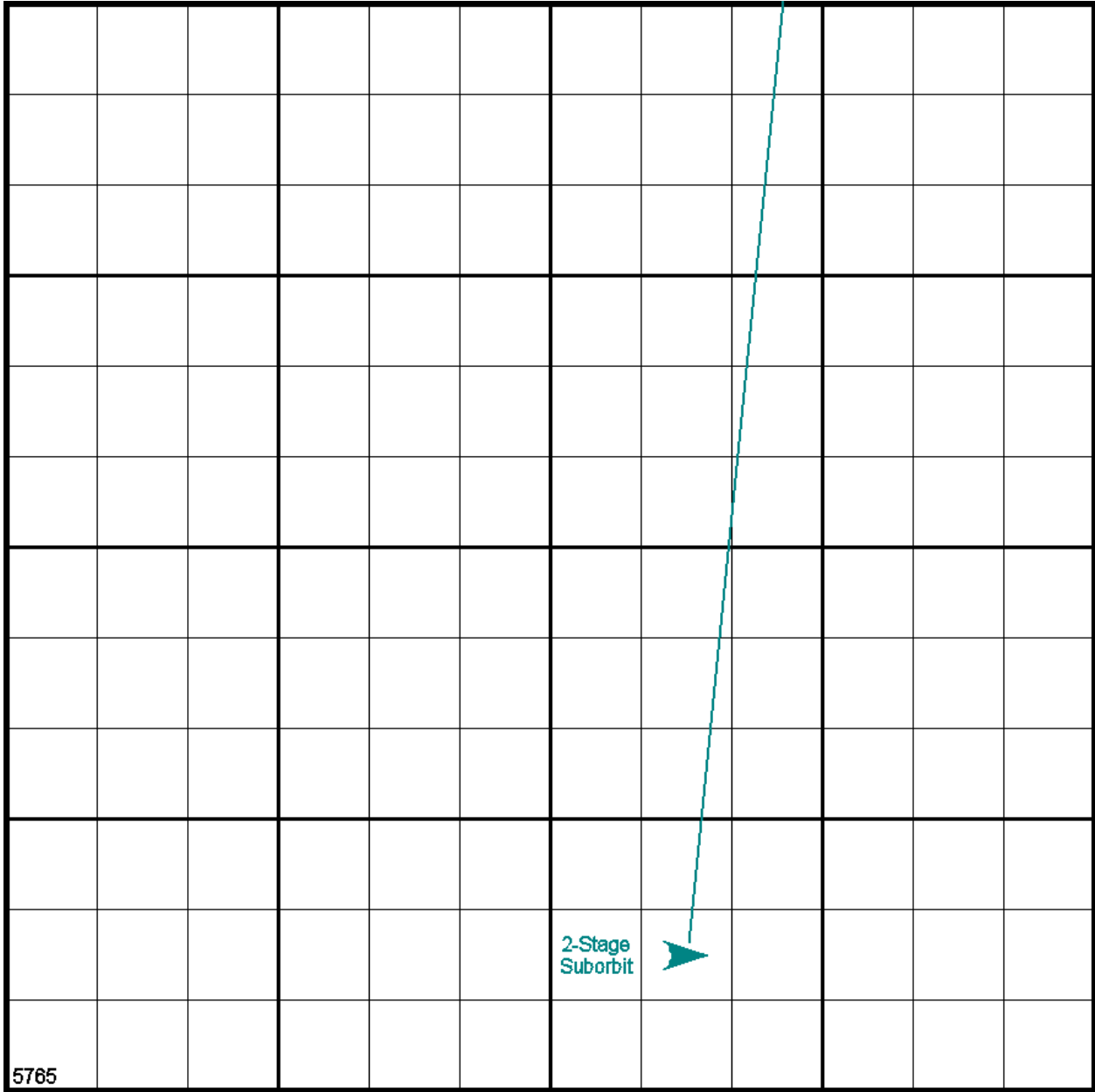
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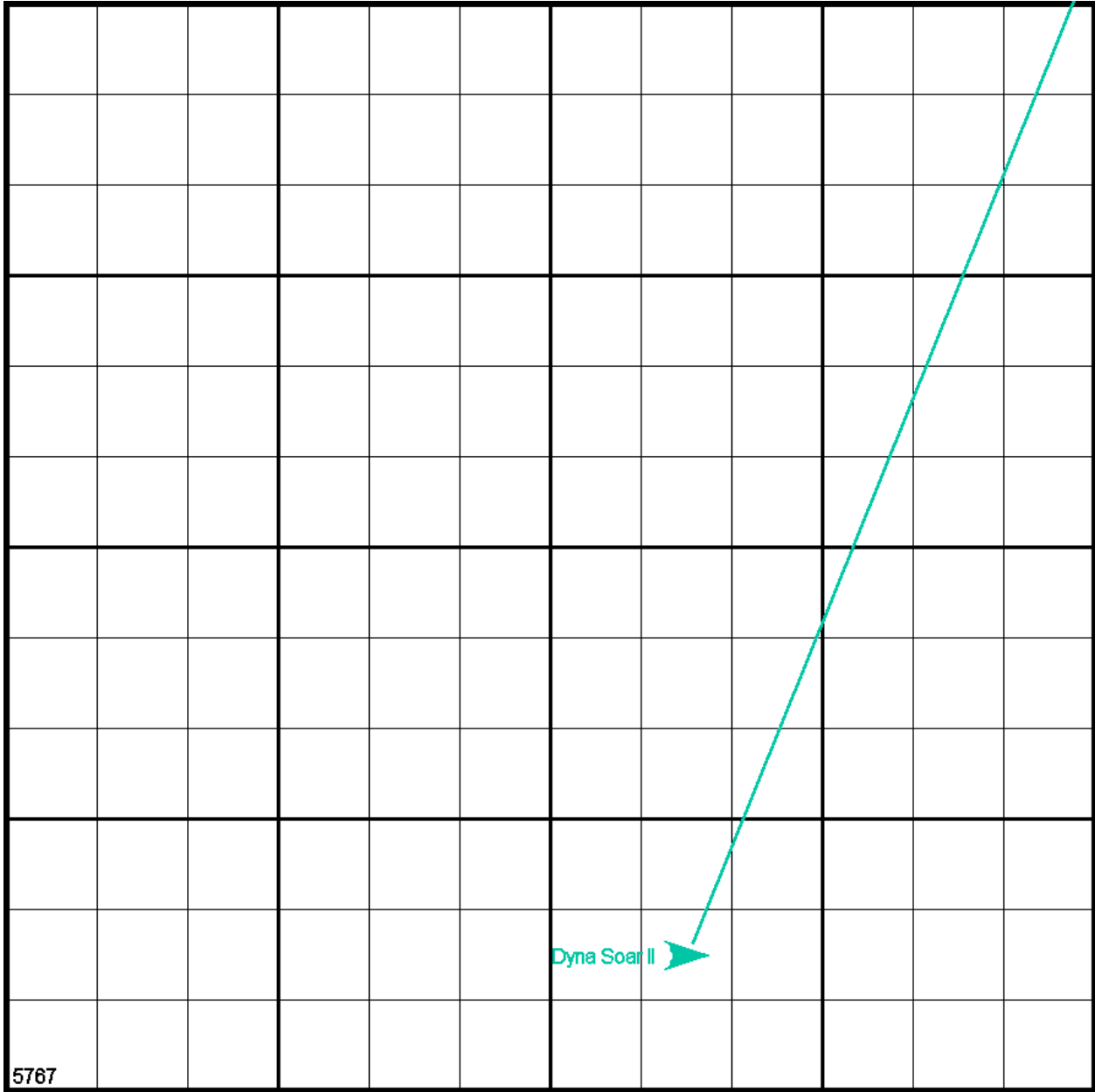
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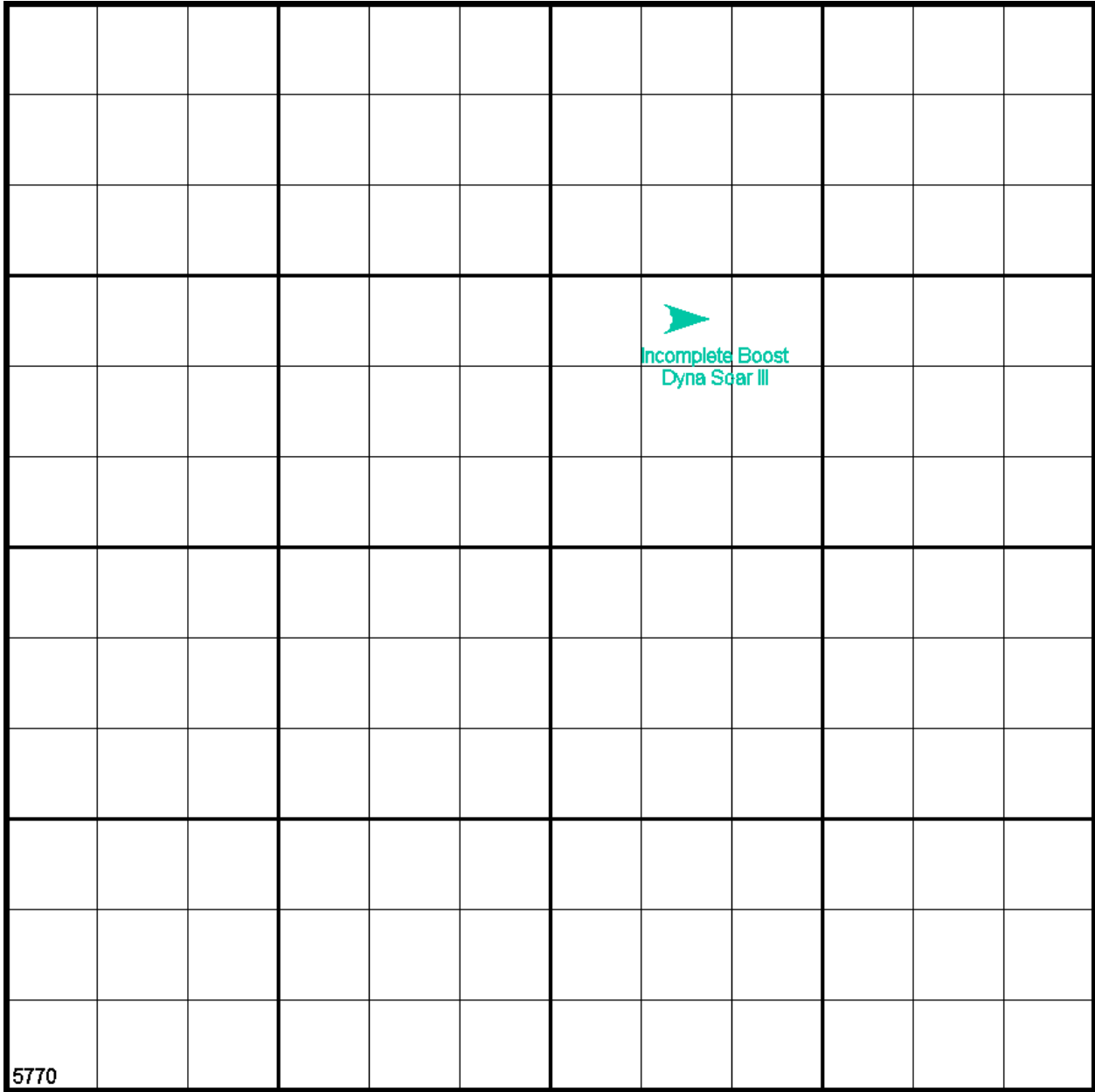


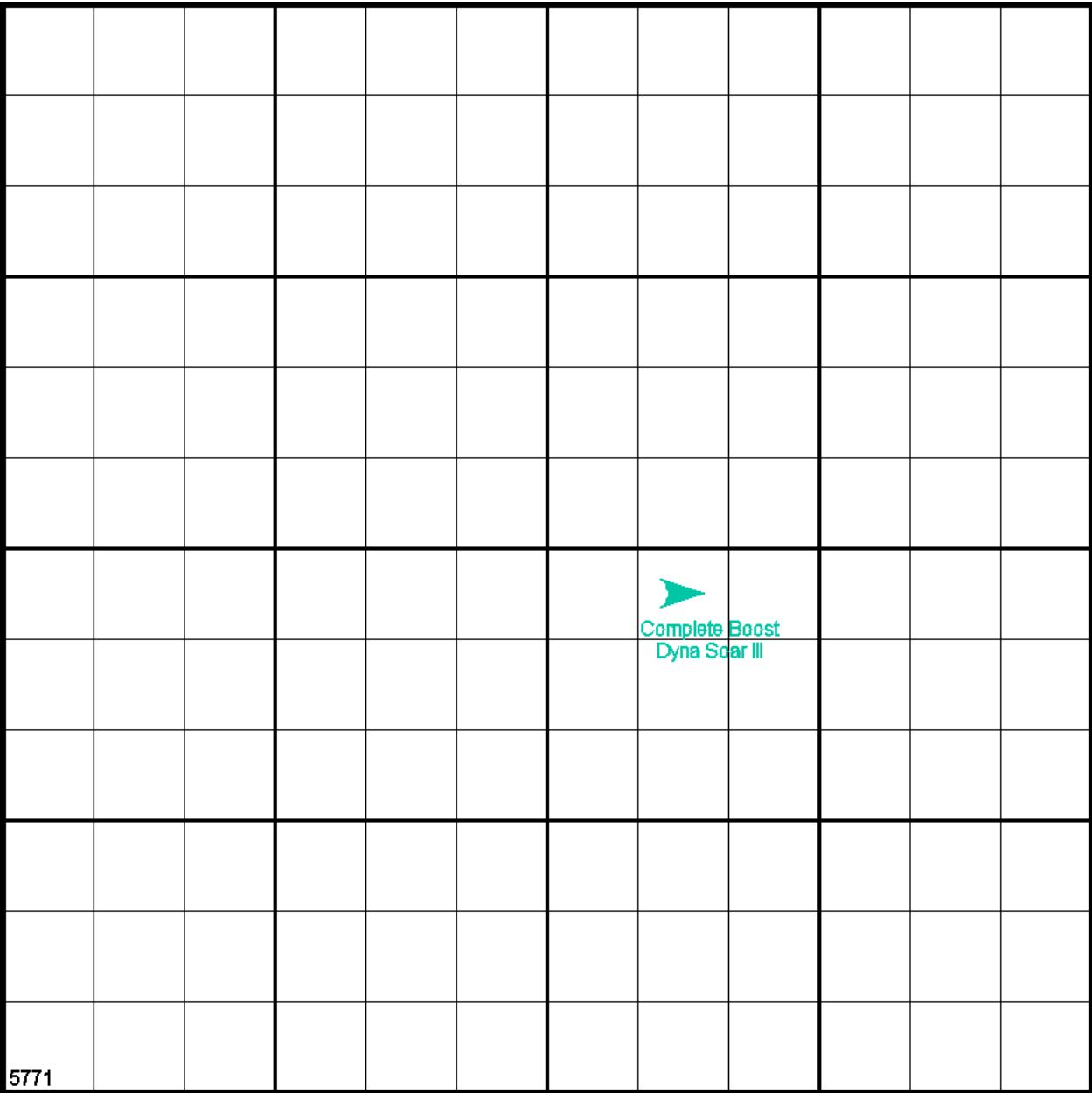
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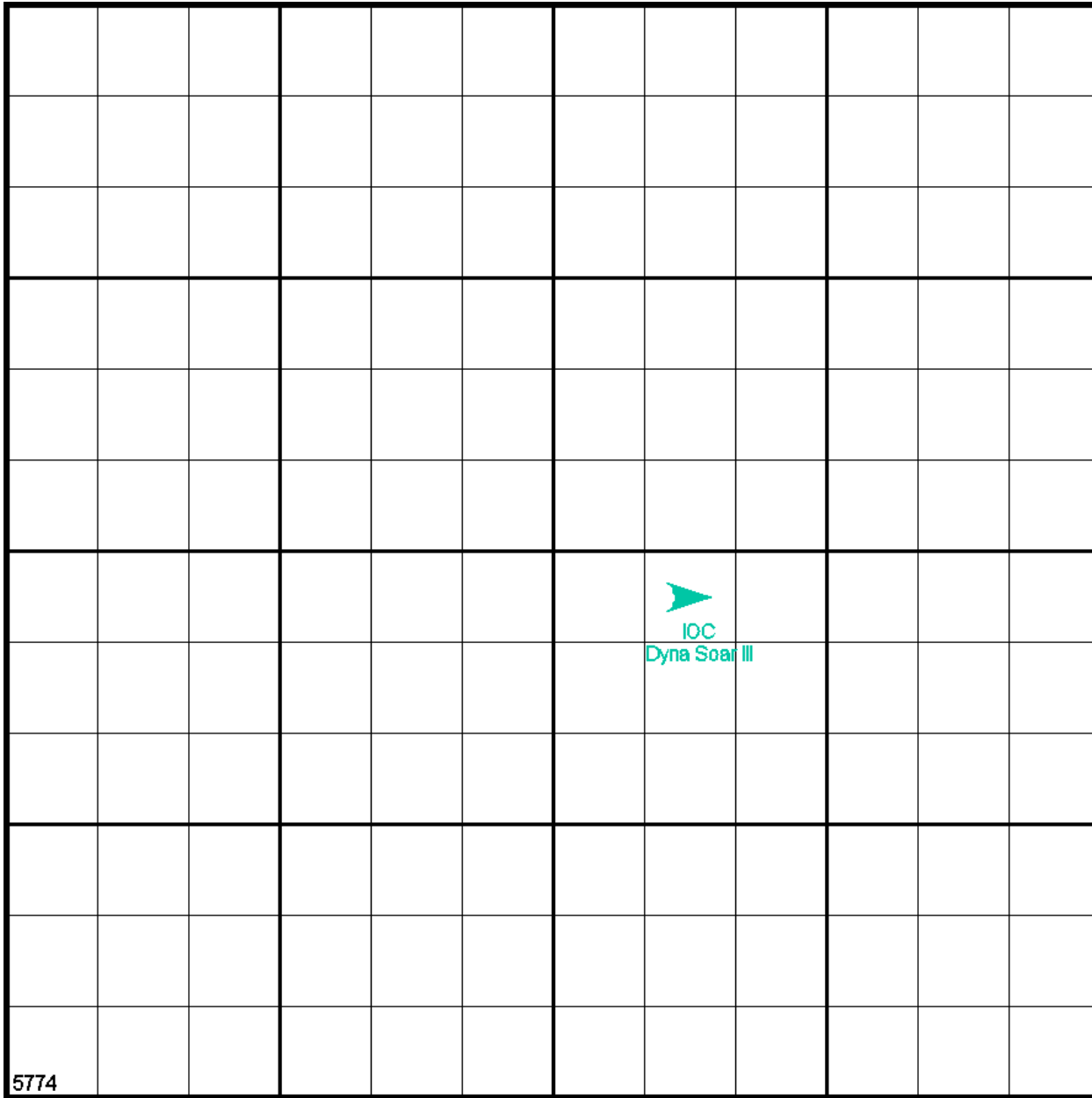
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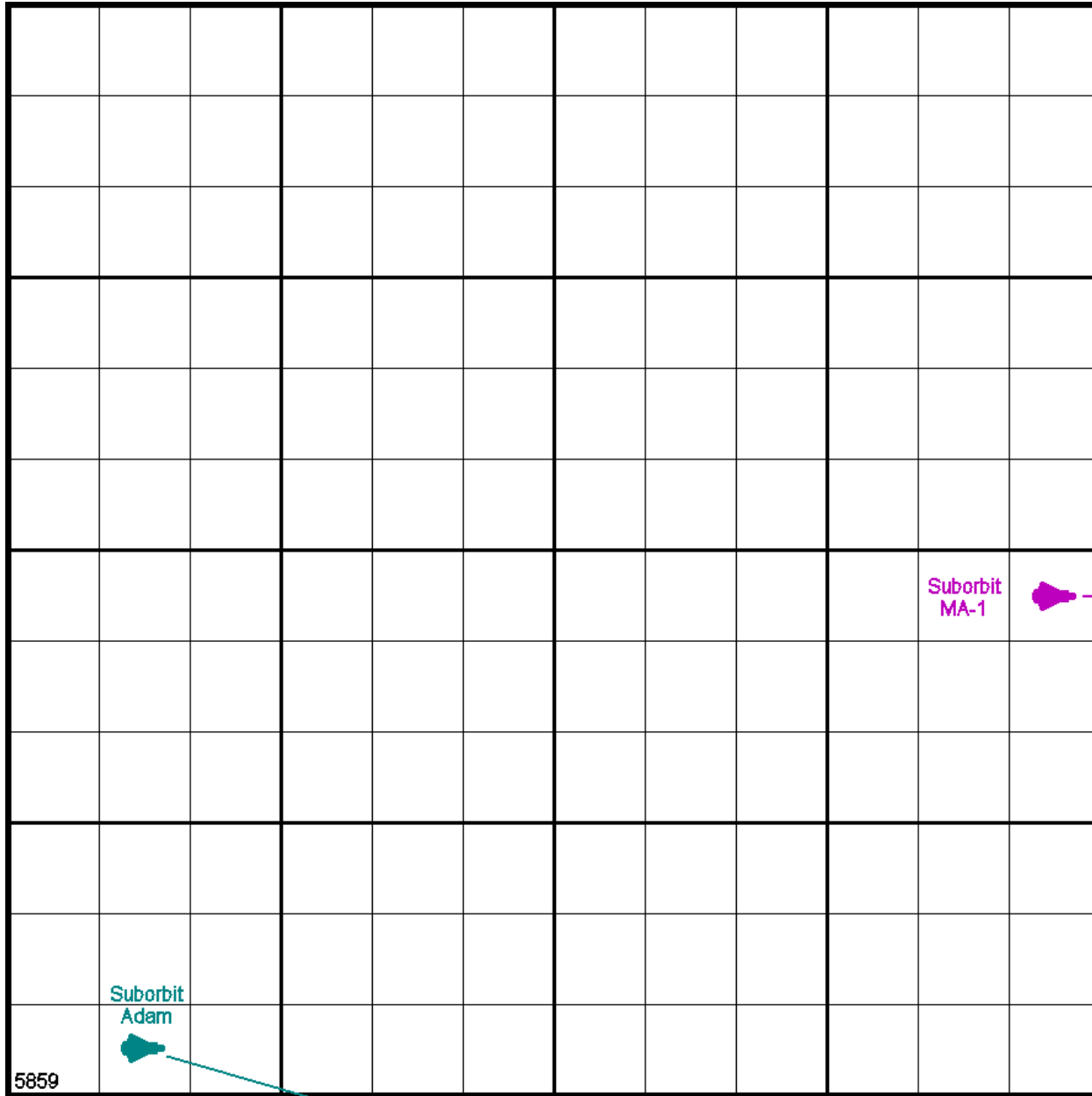
						IOC Dyna Soar II 					
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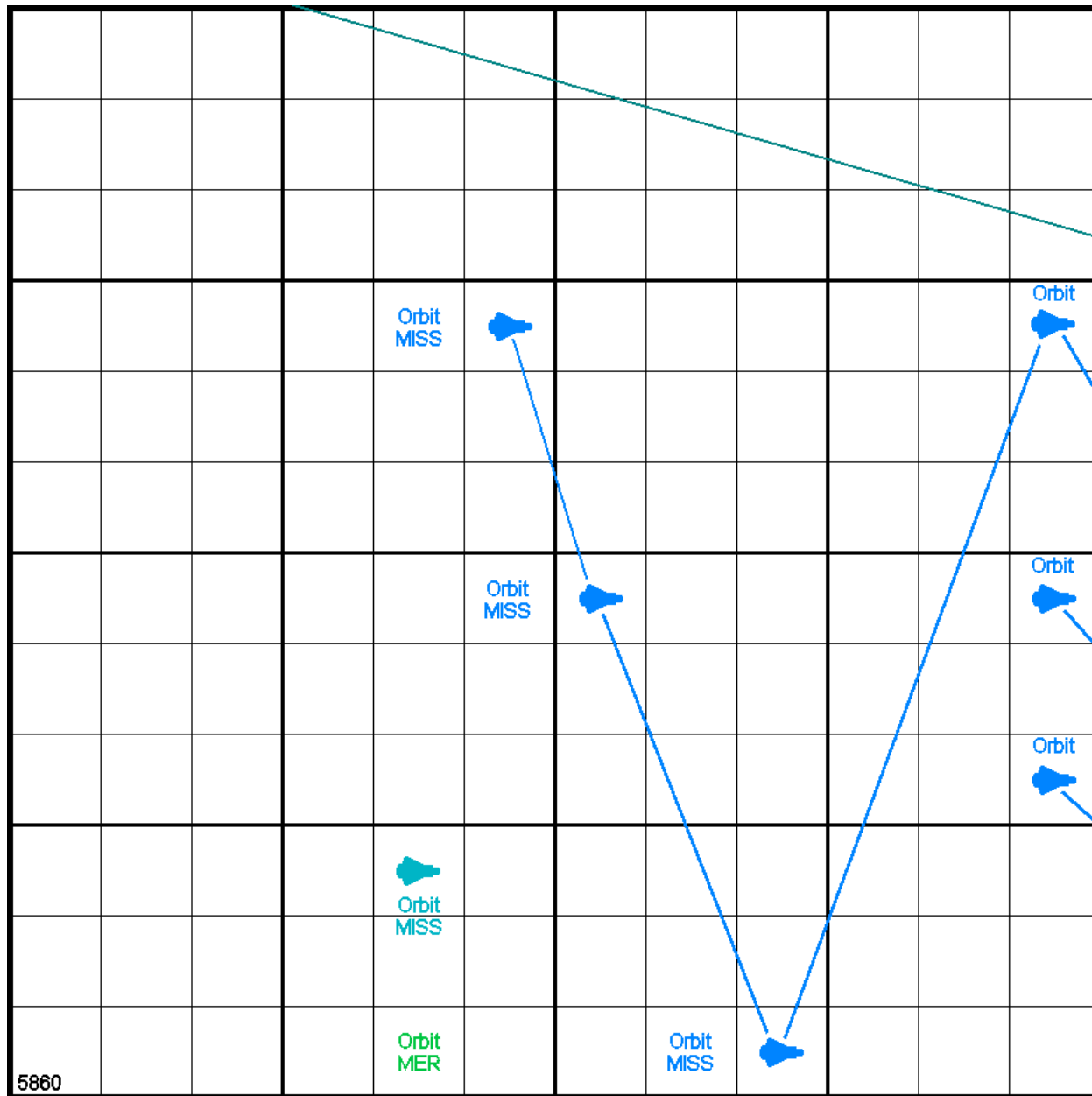




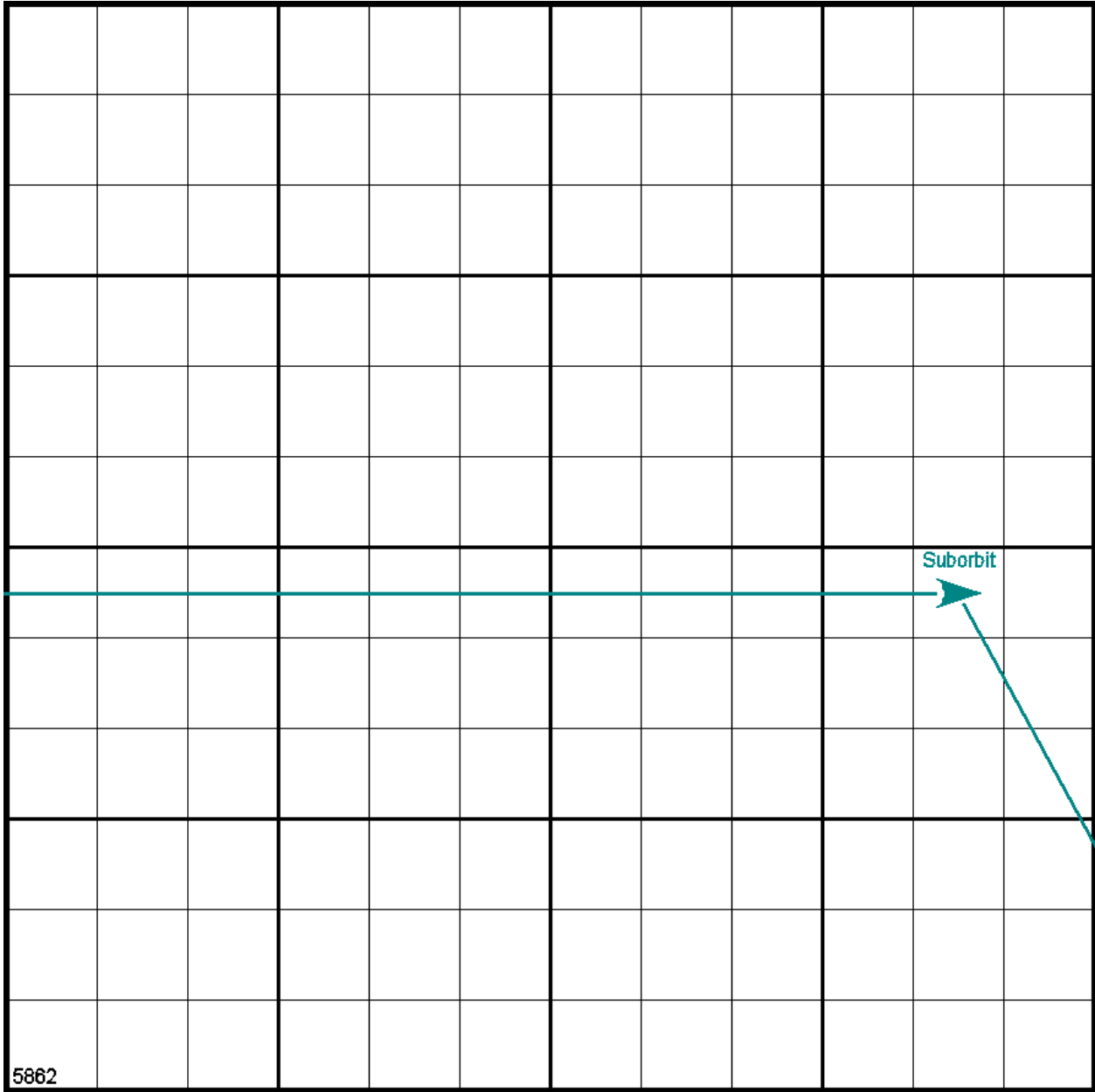
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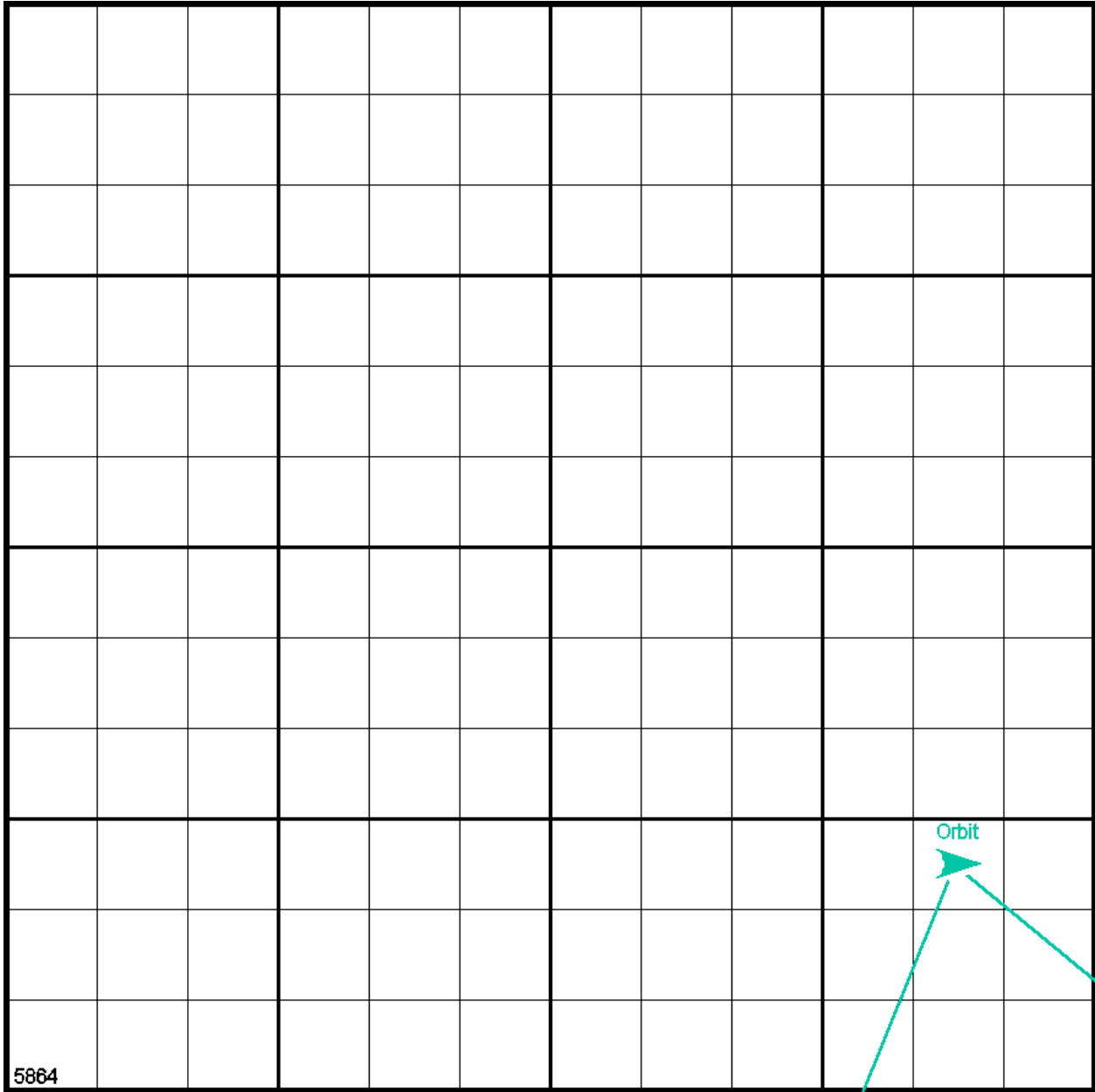




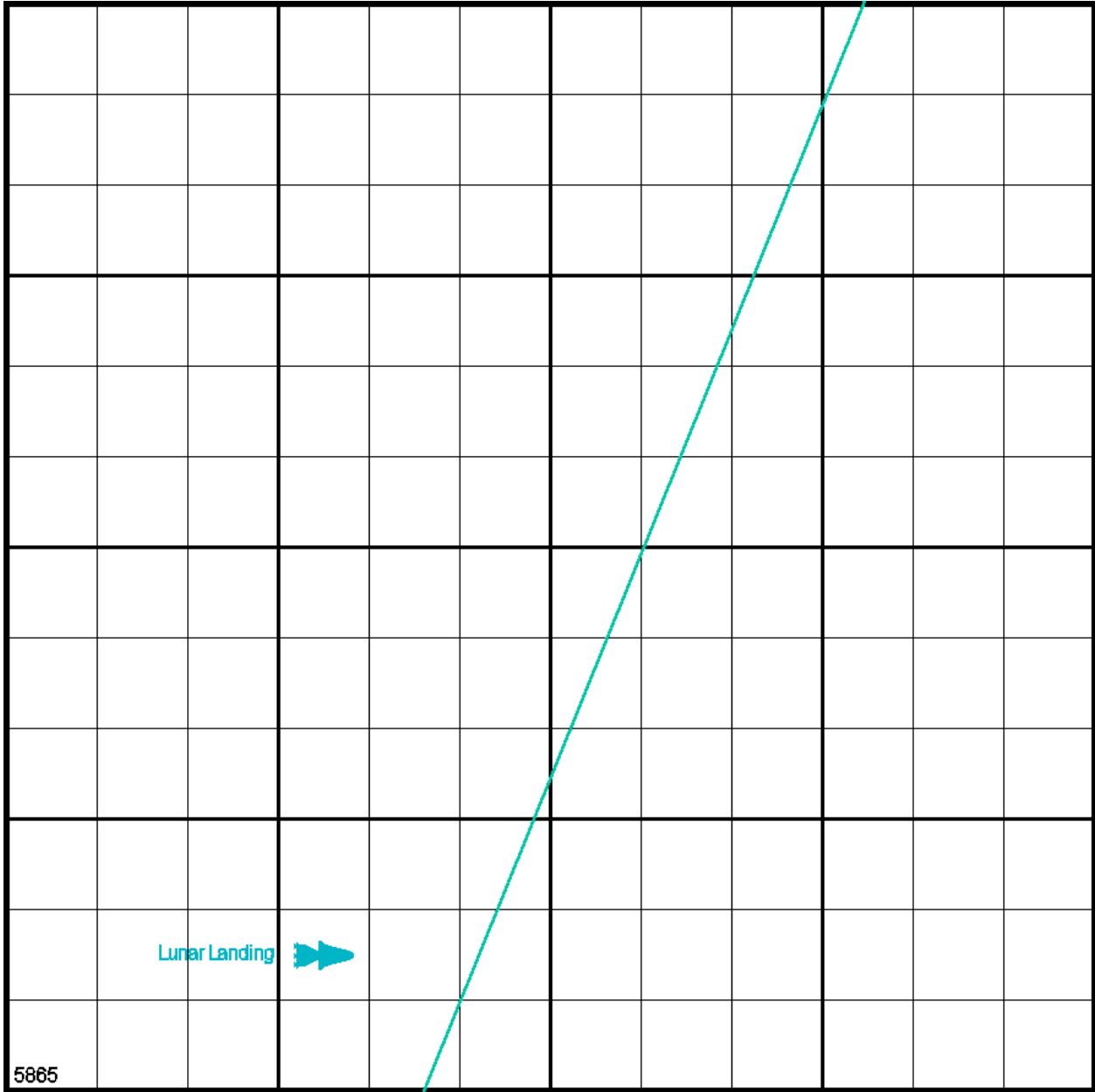


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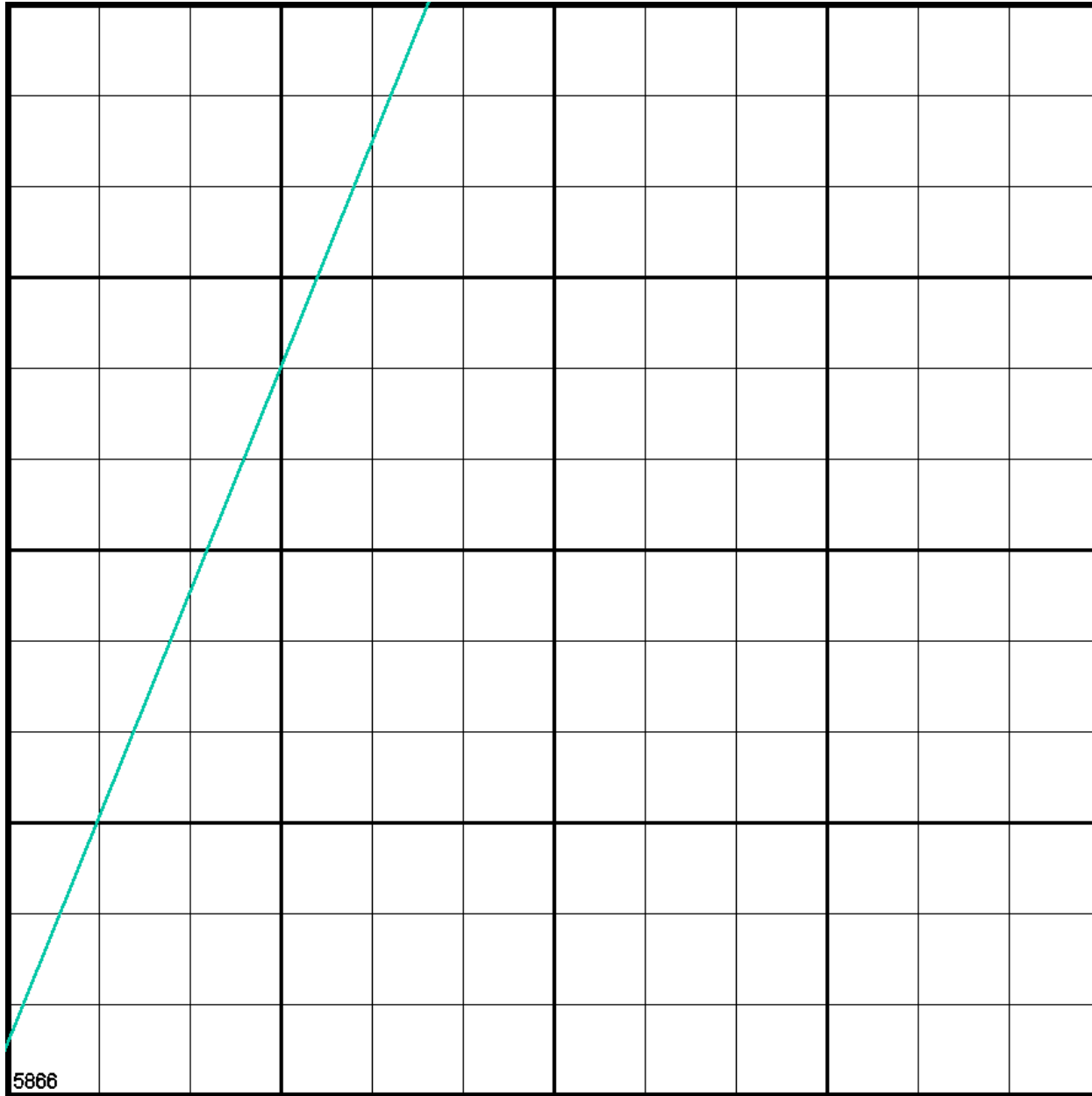




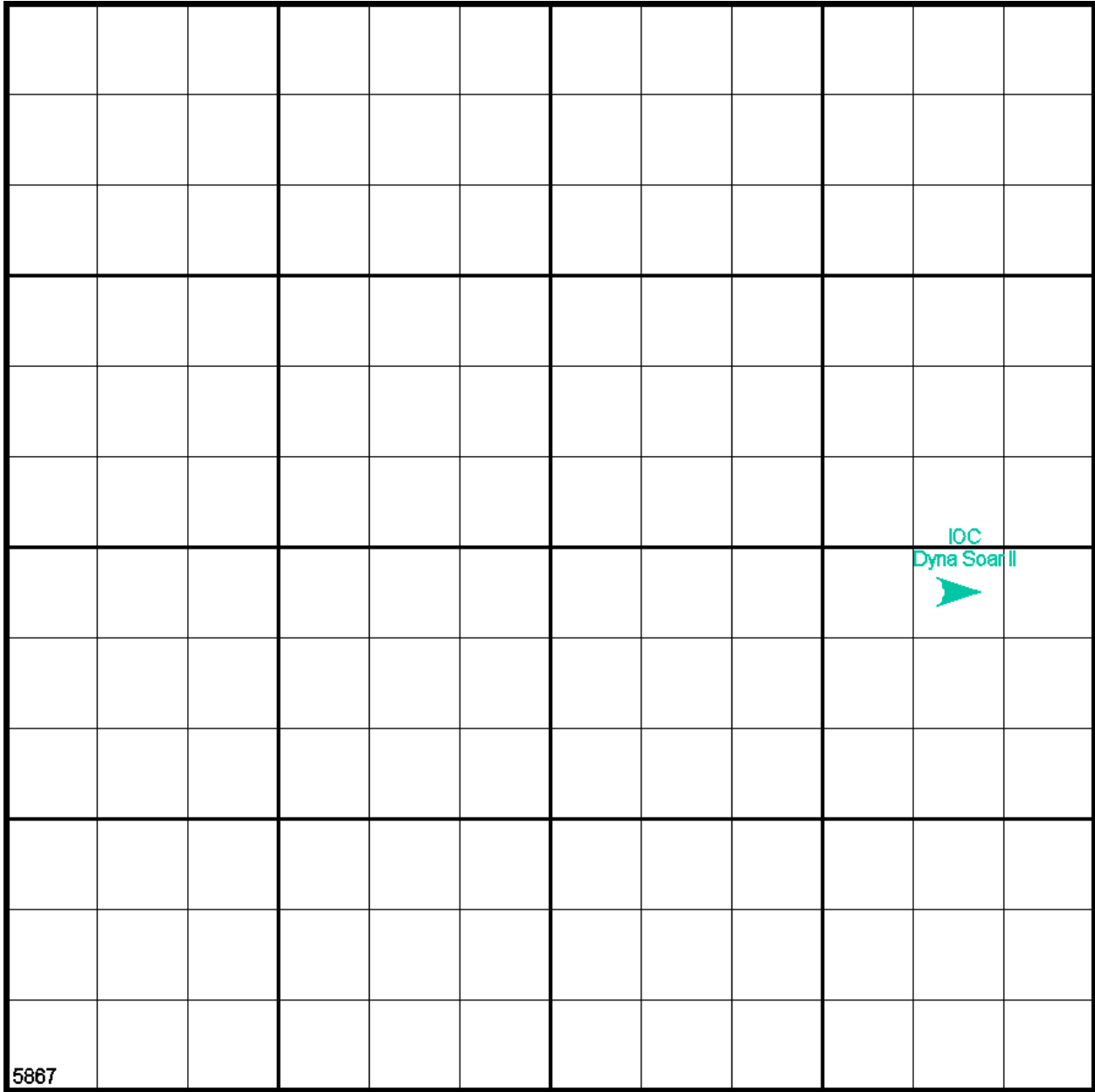
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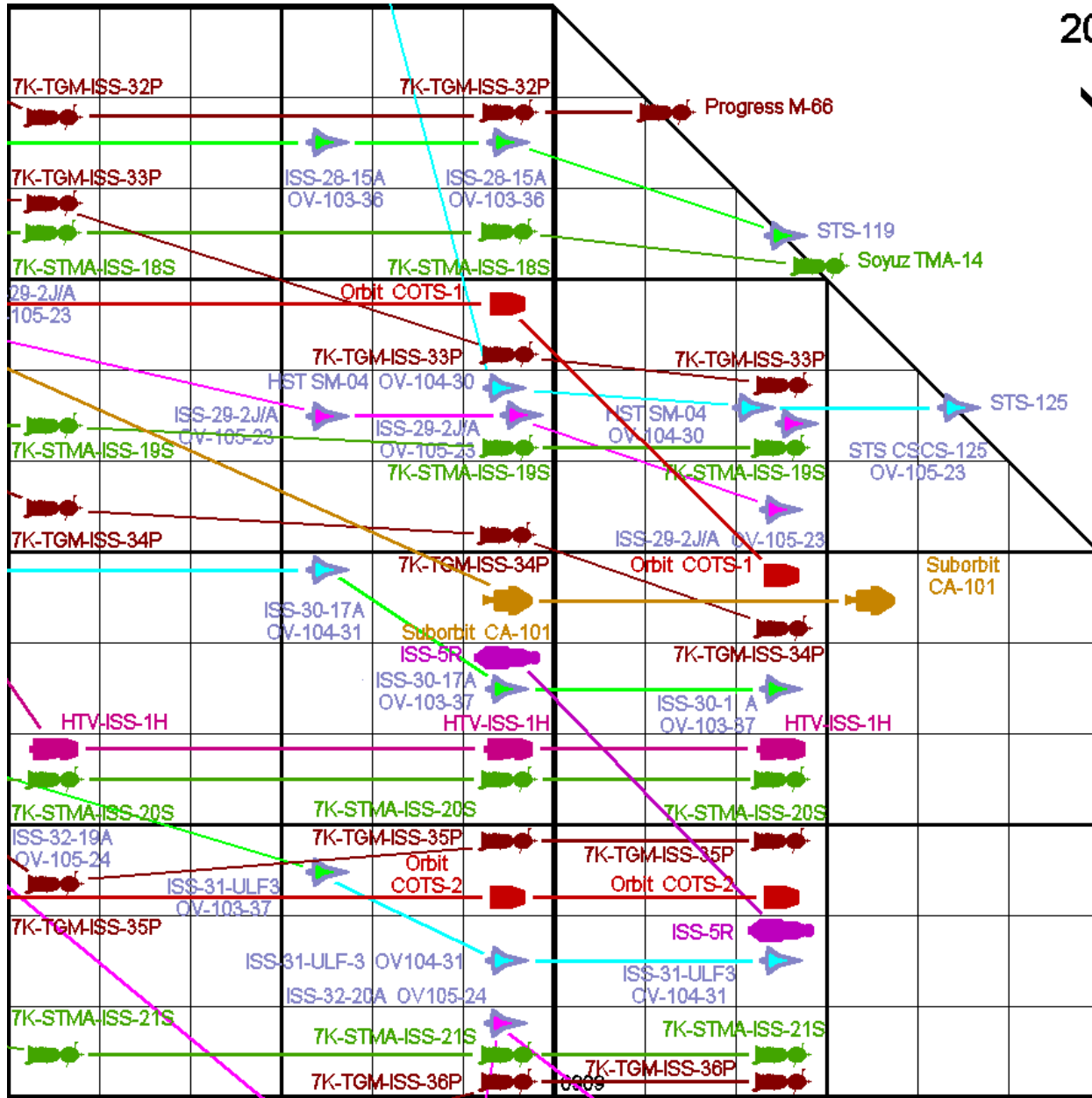
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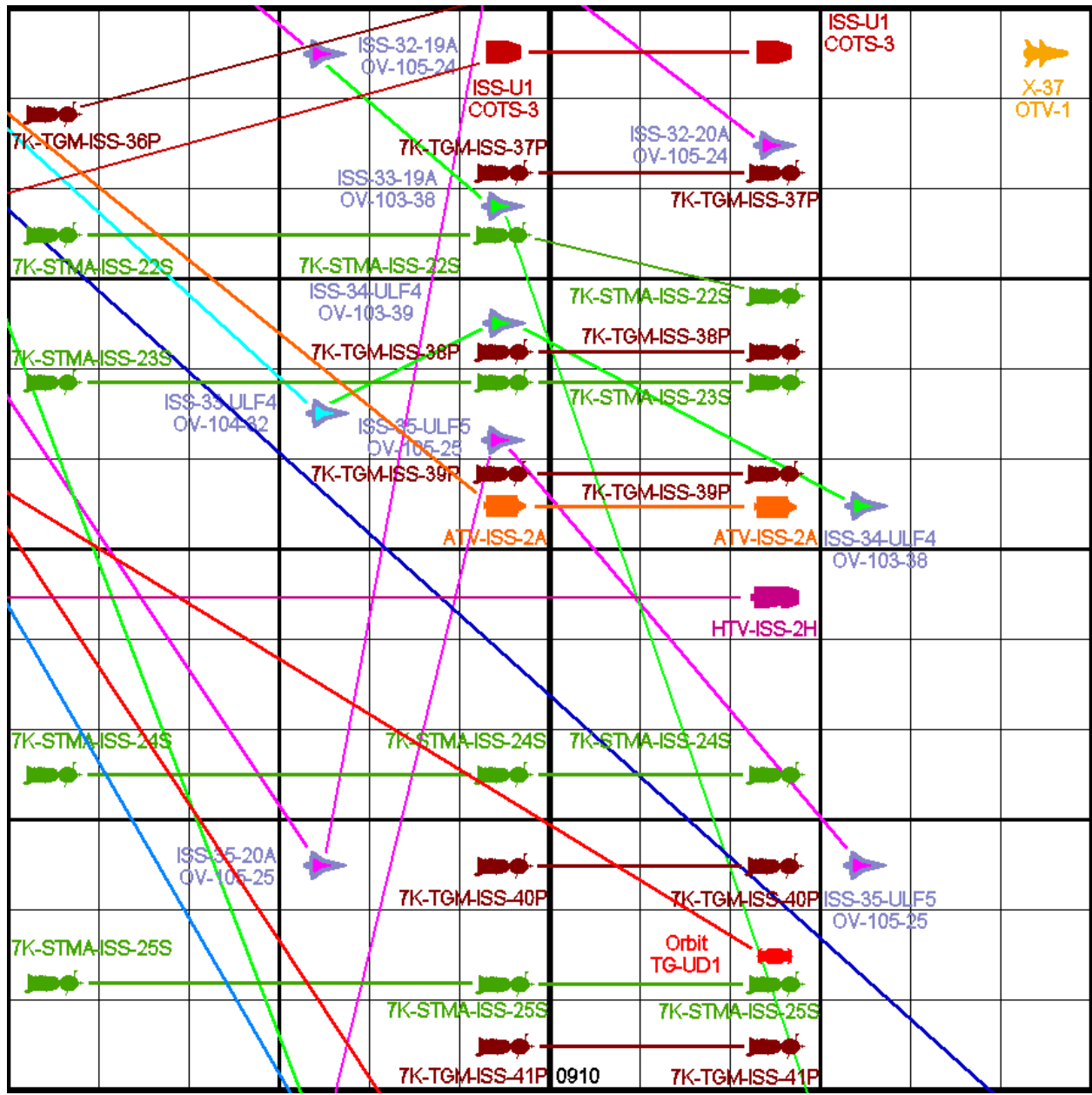


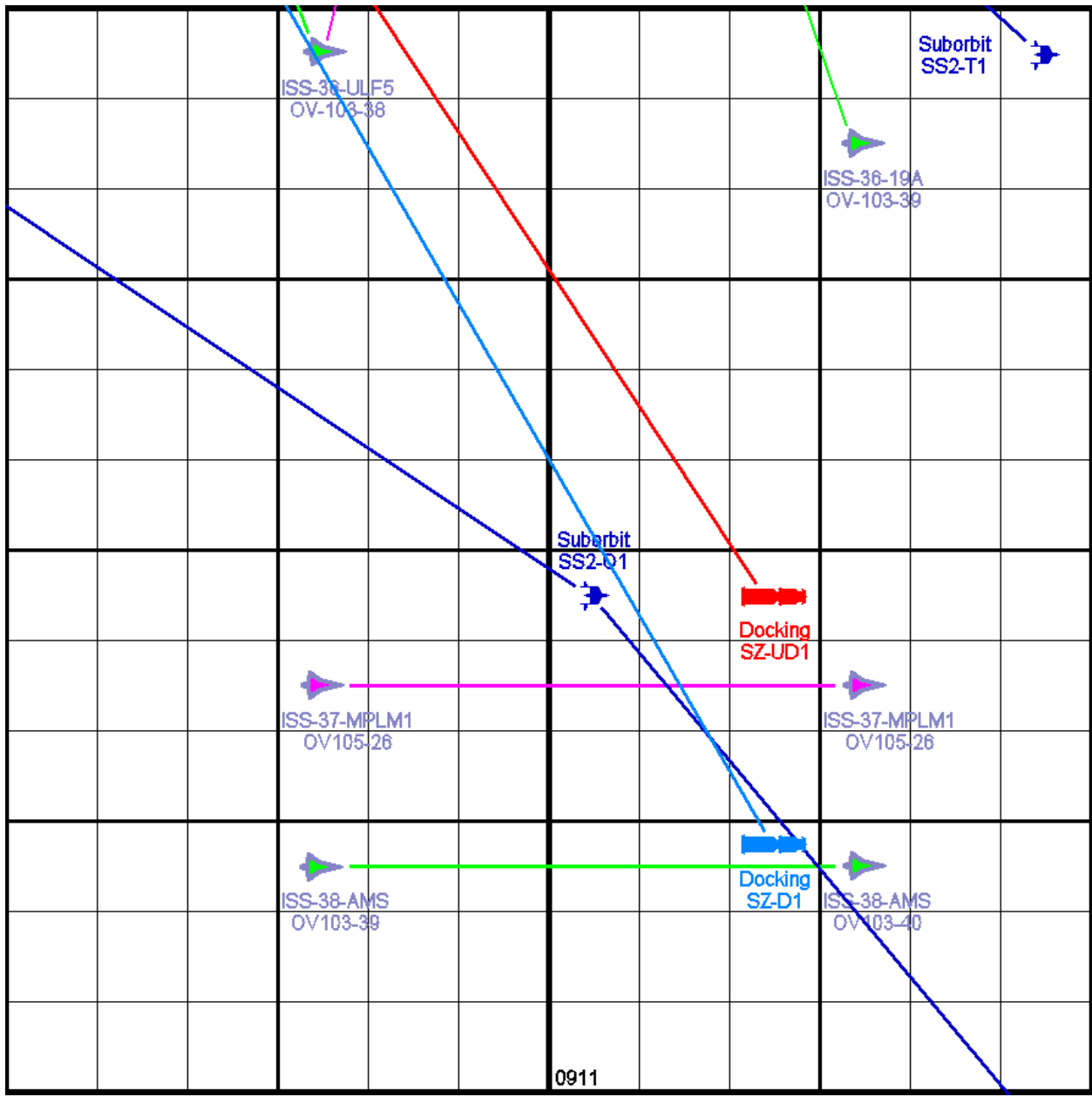
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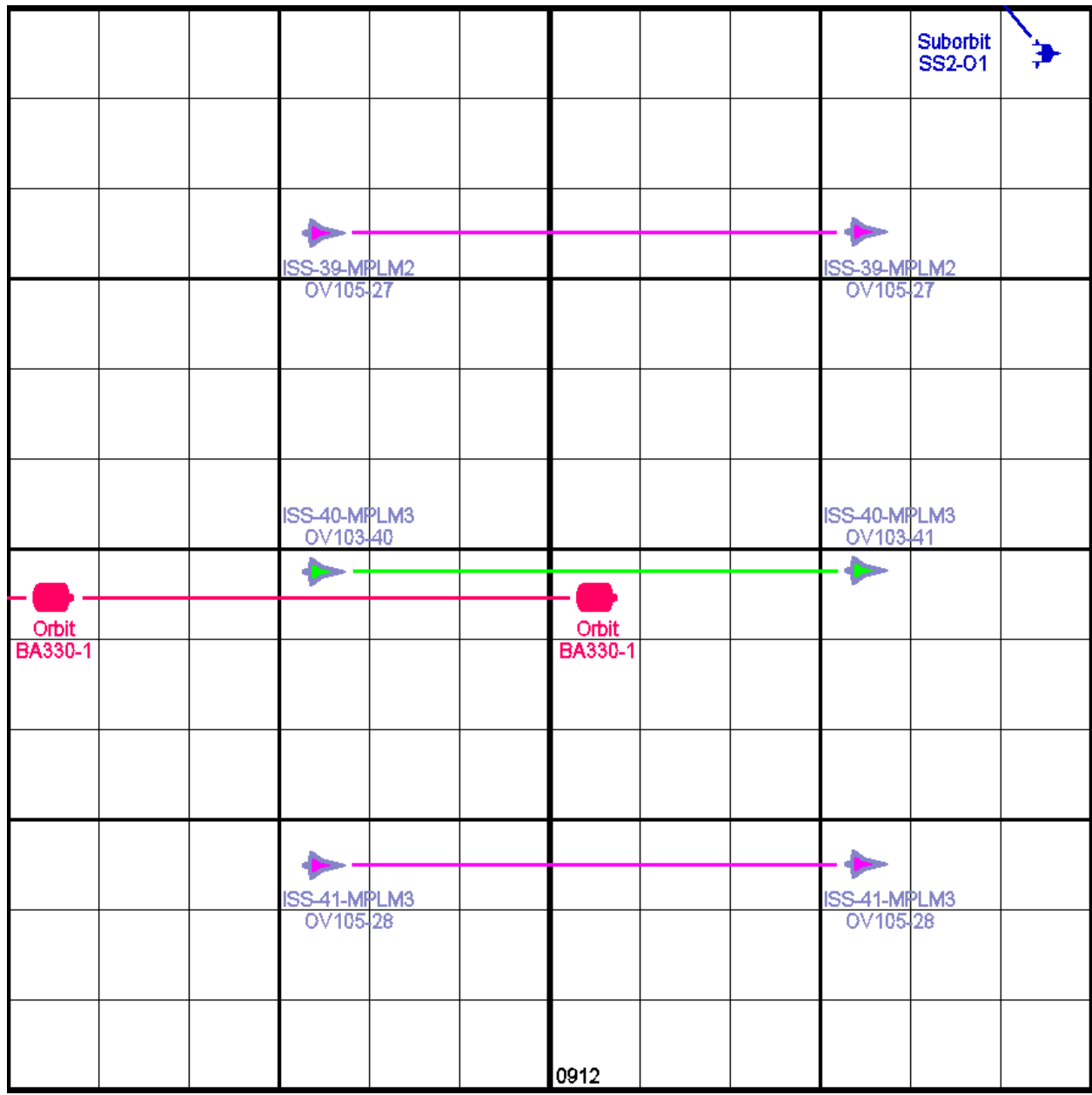


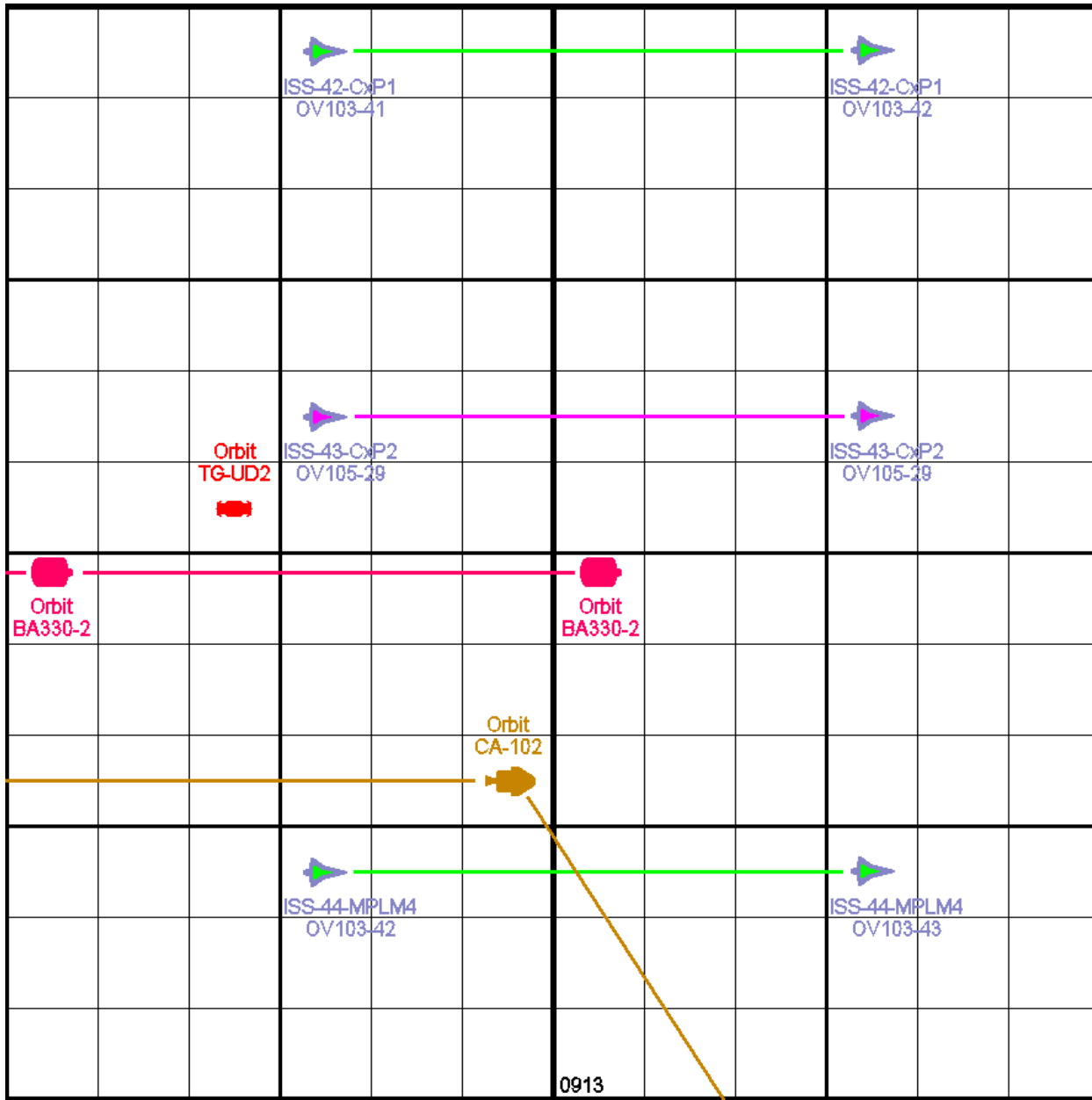
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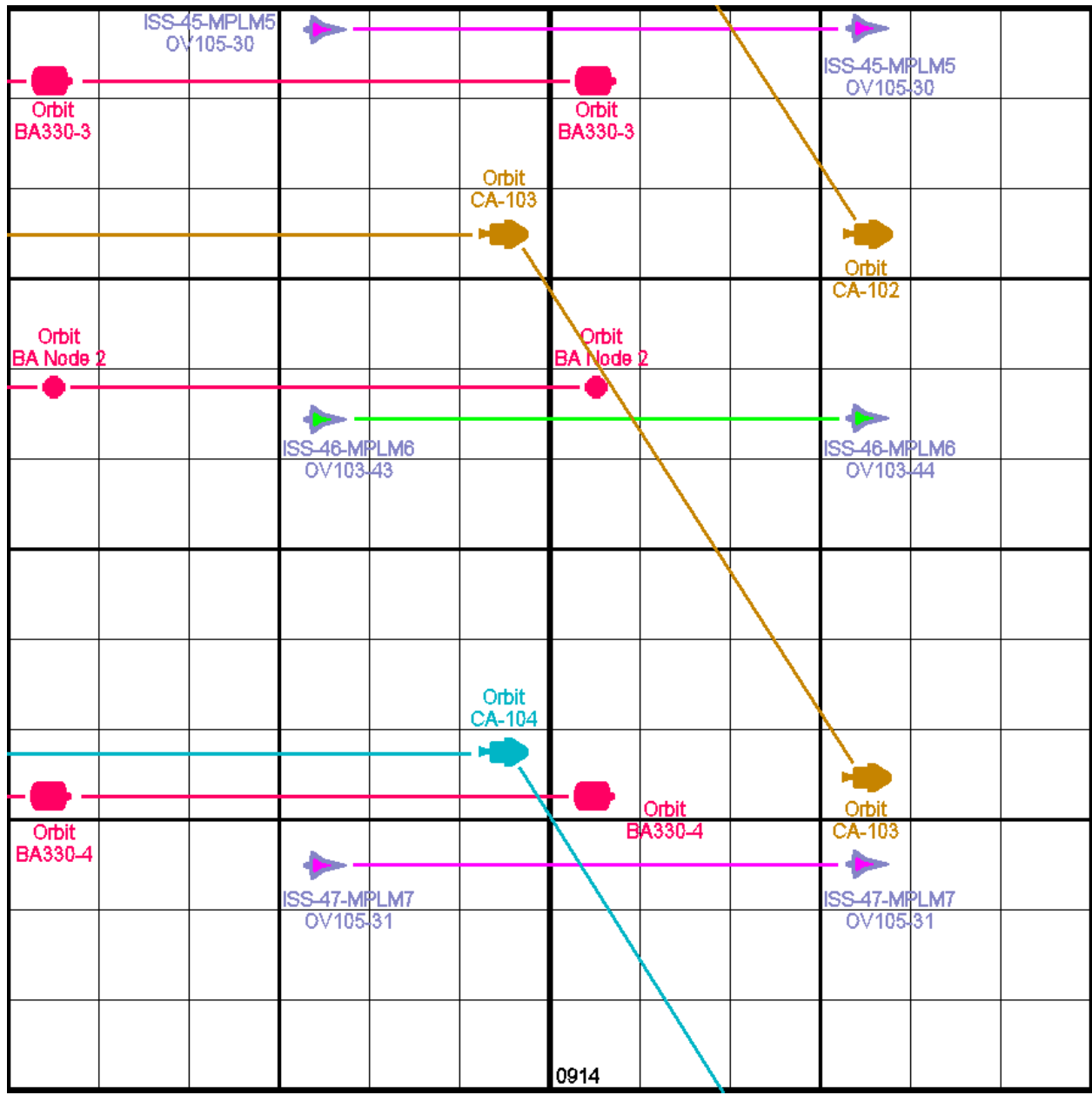


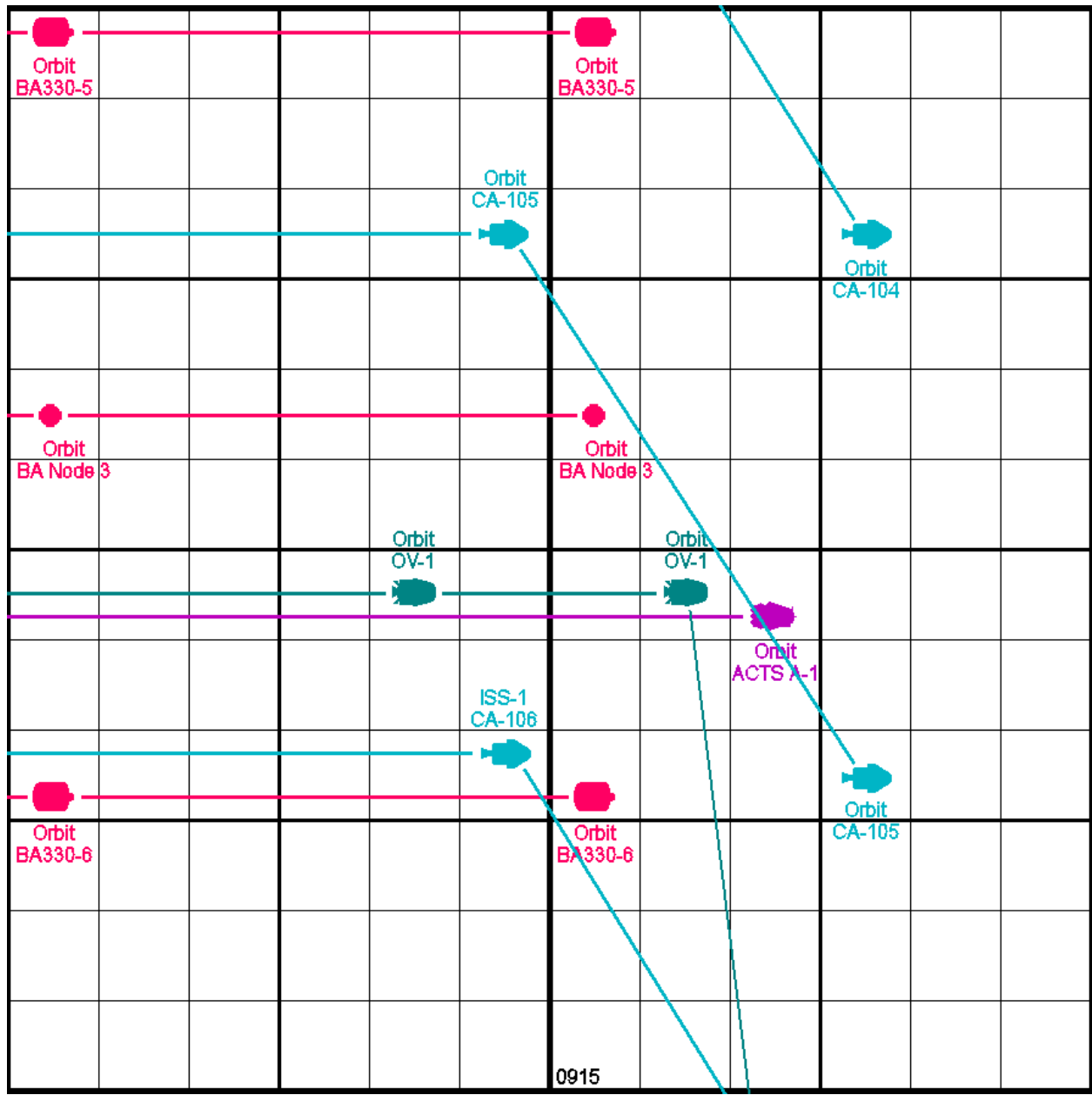


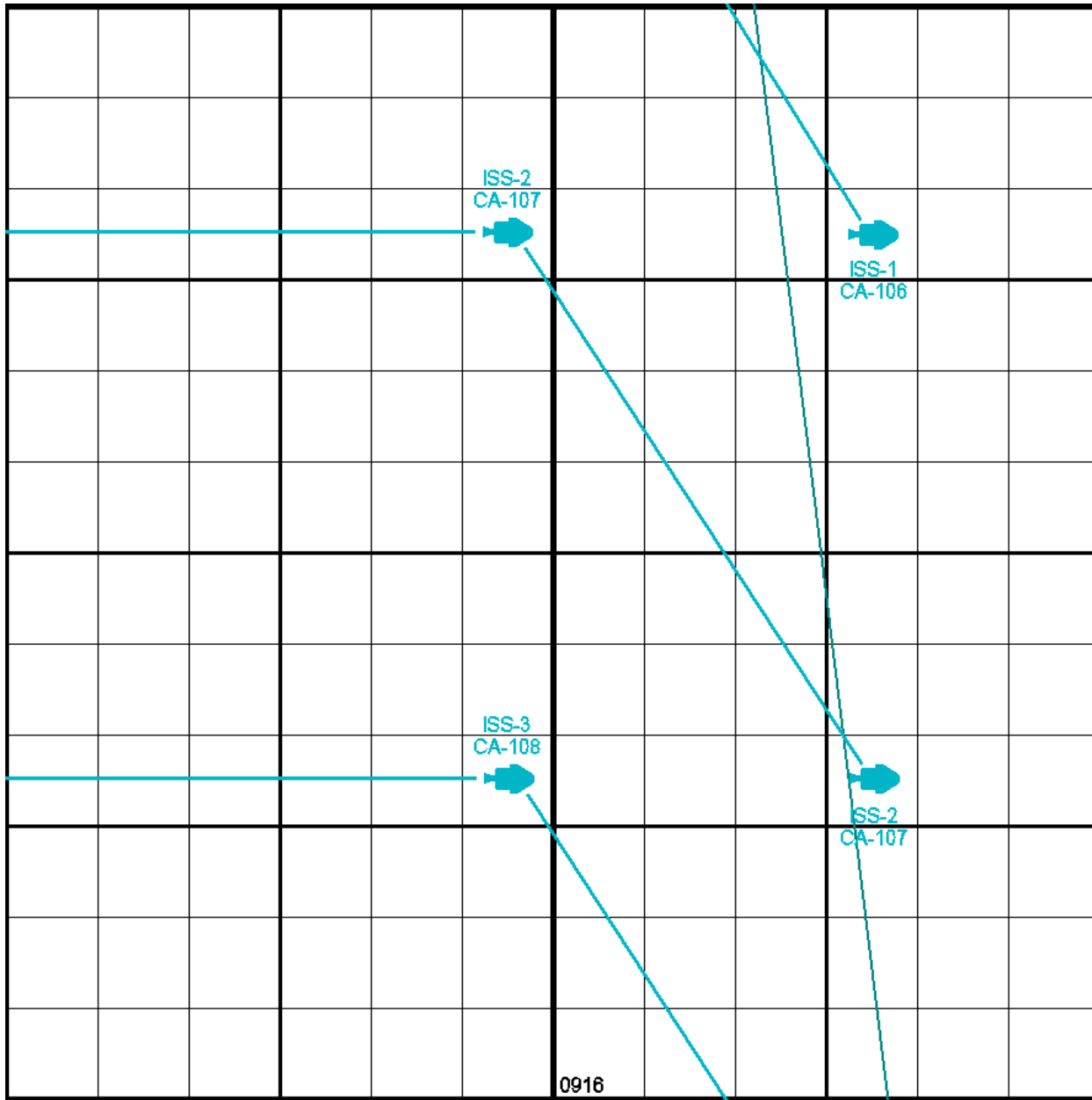


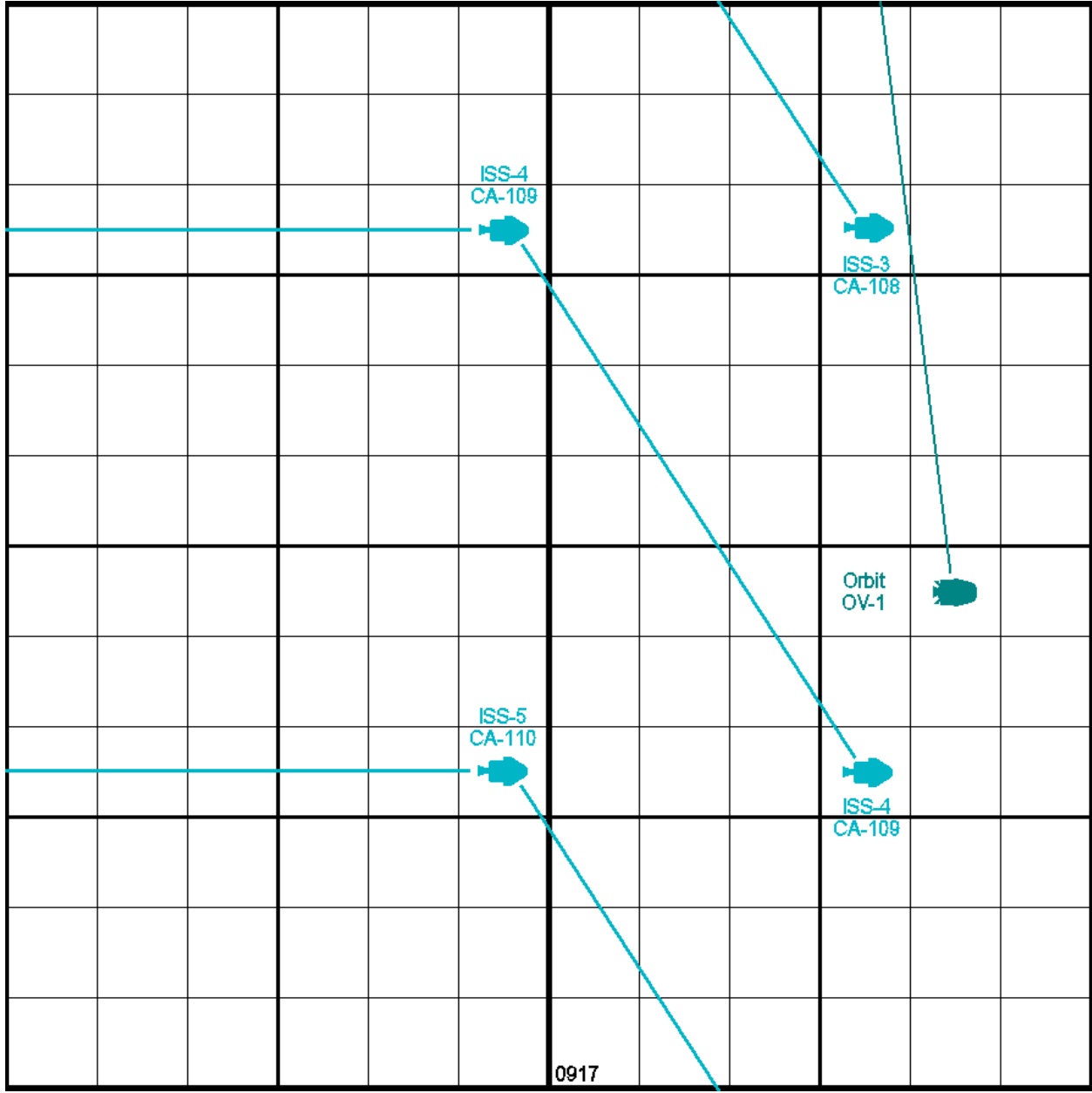


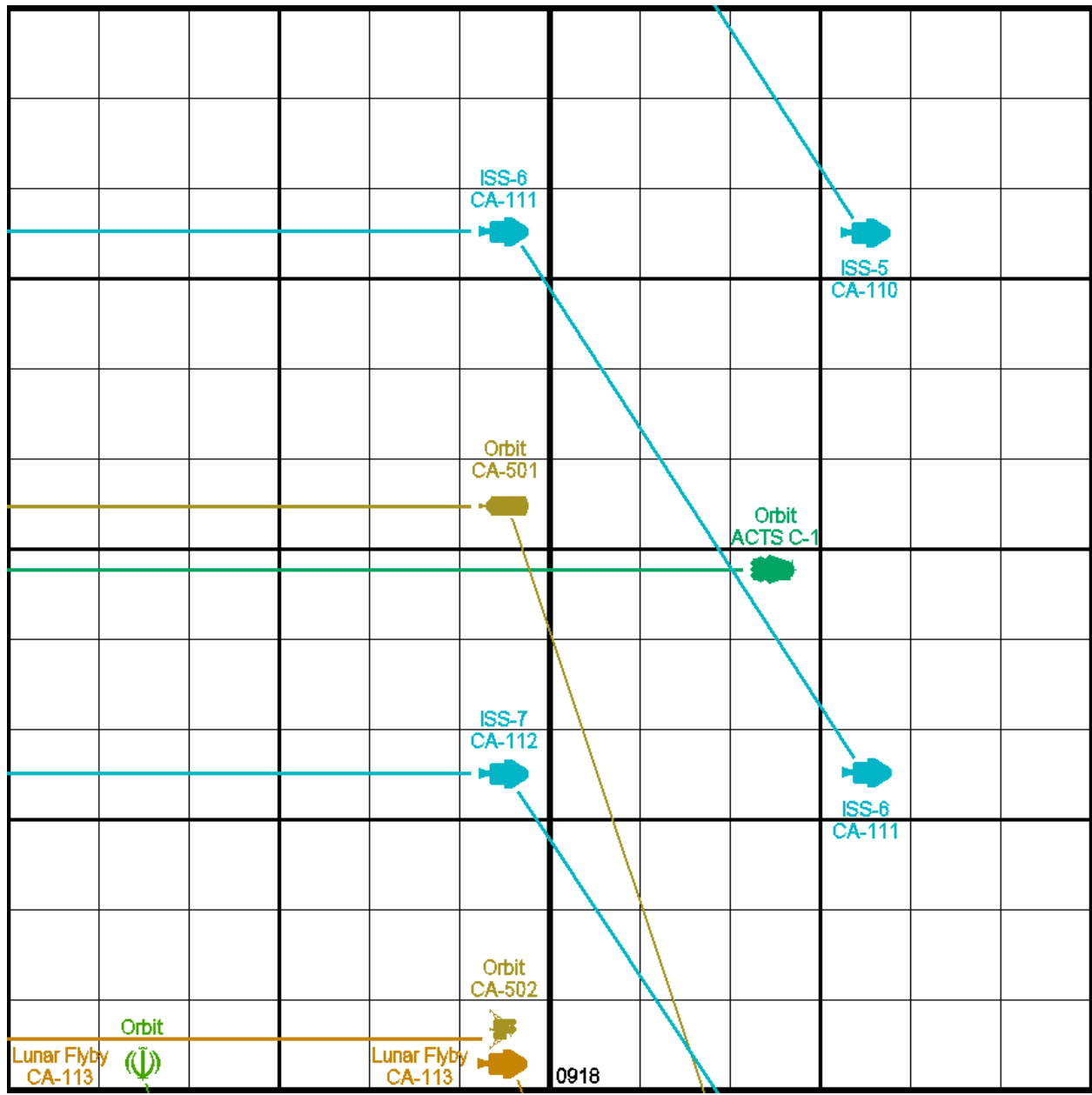


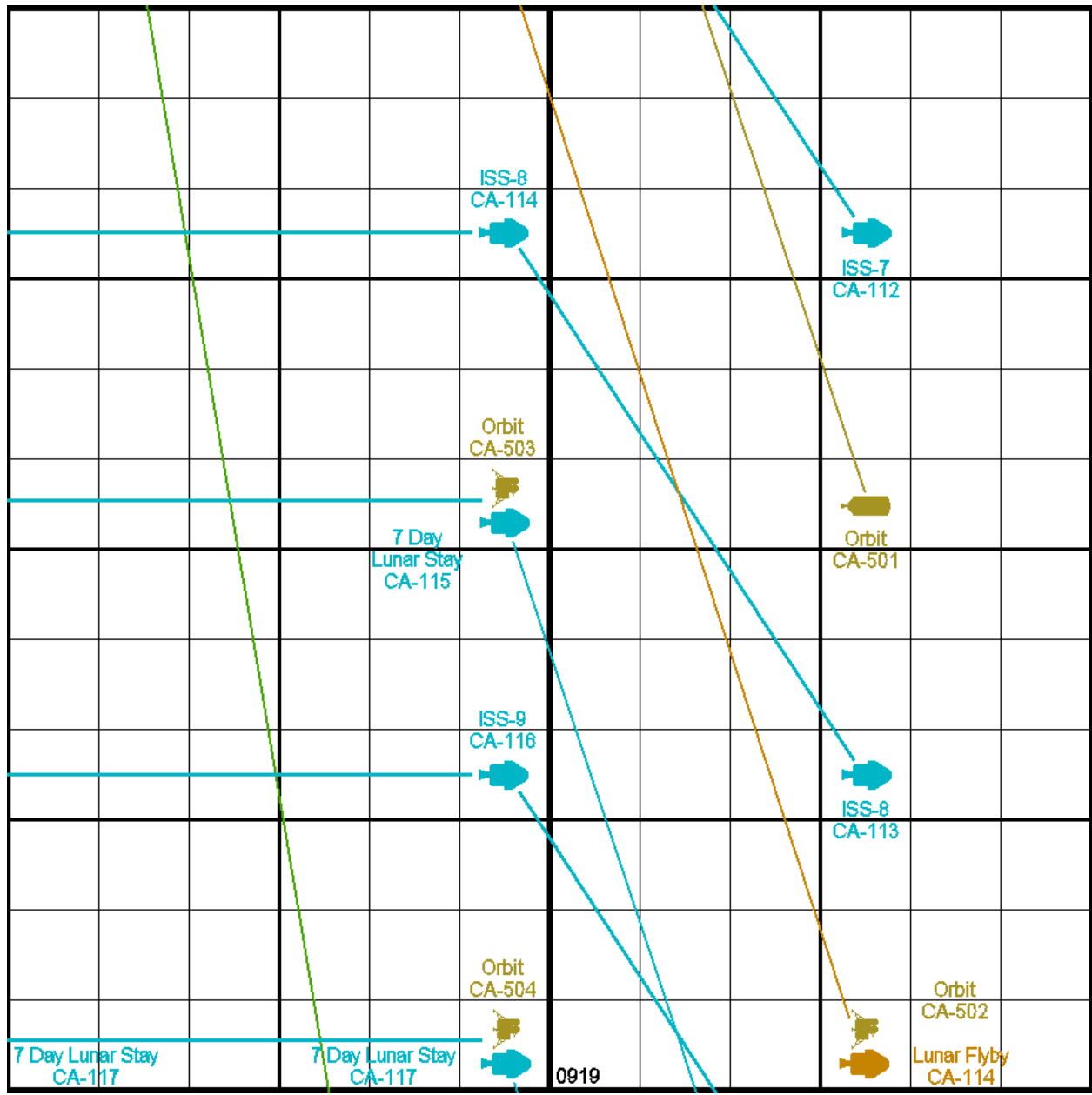


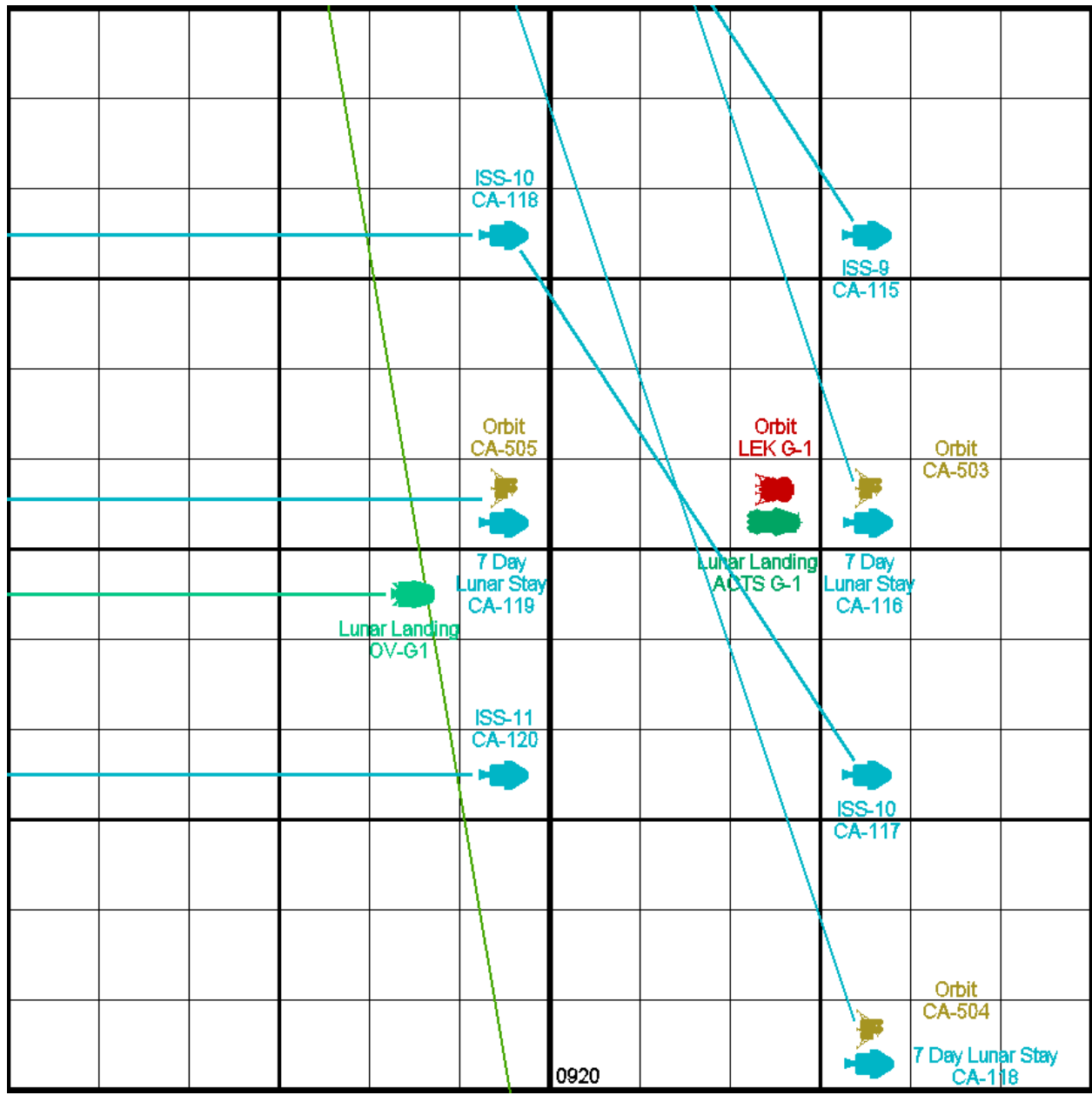


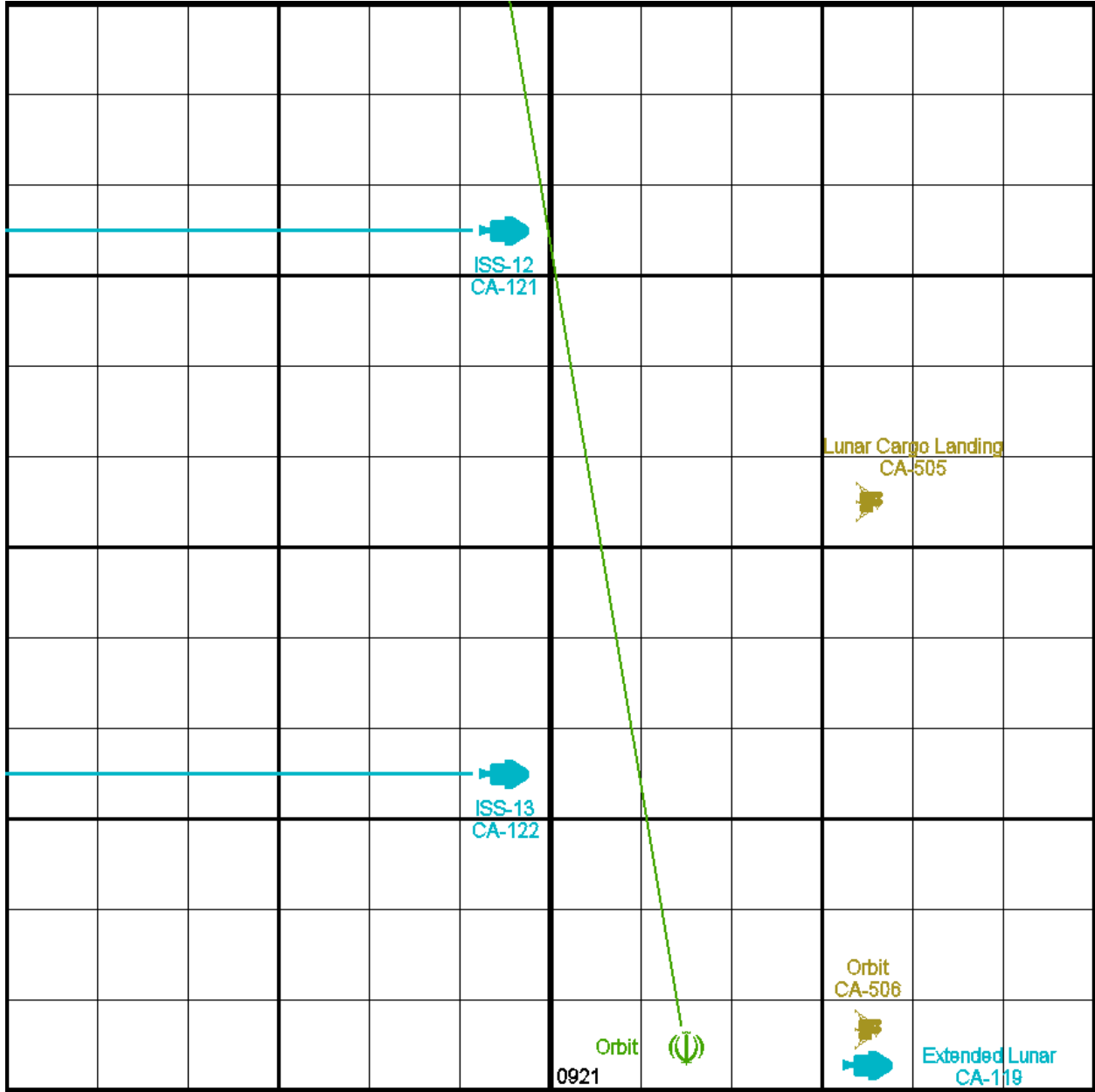


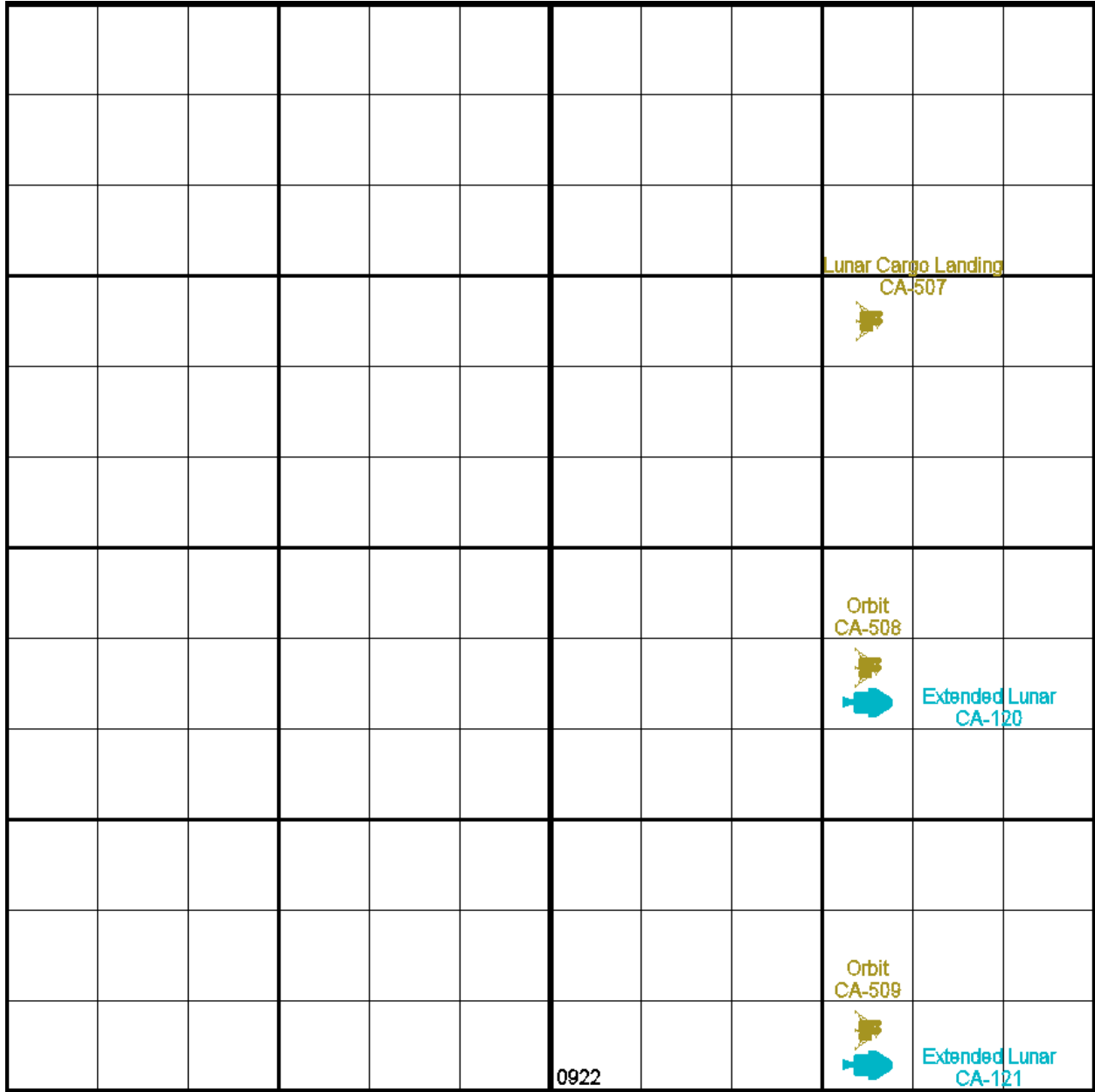


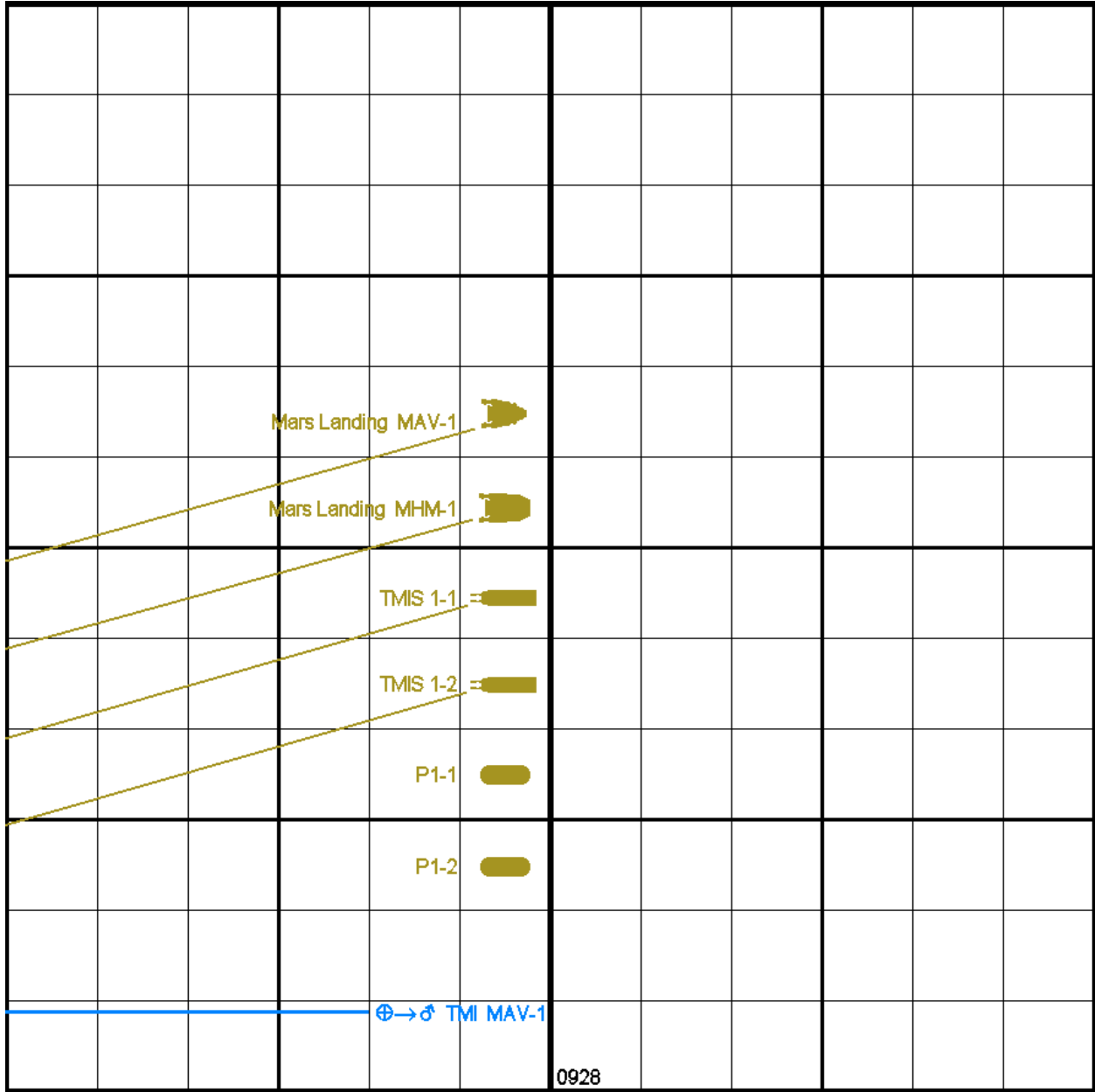


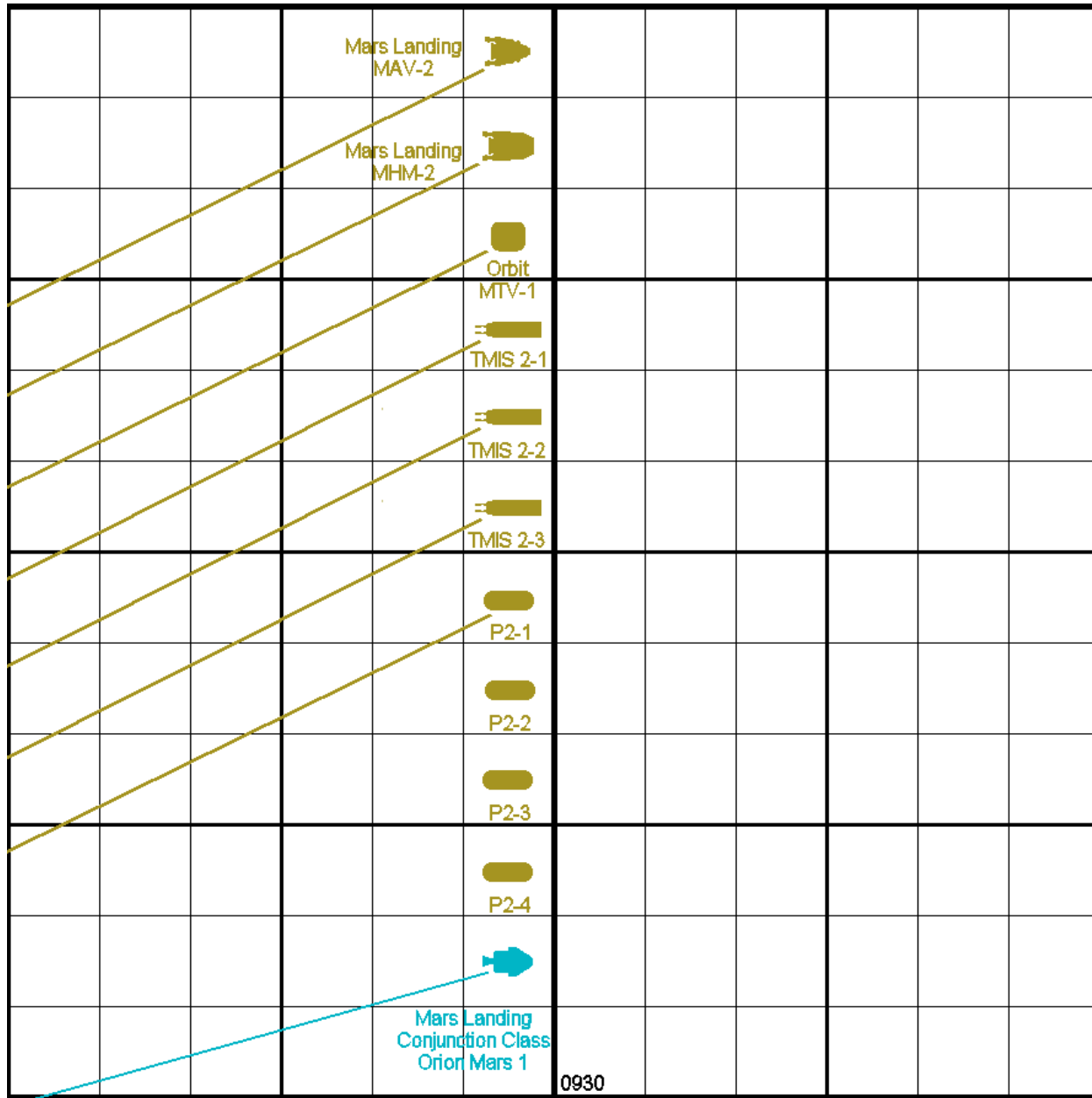


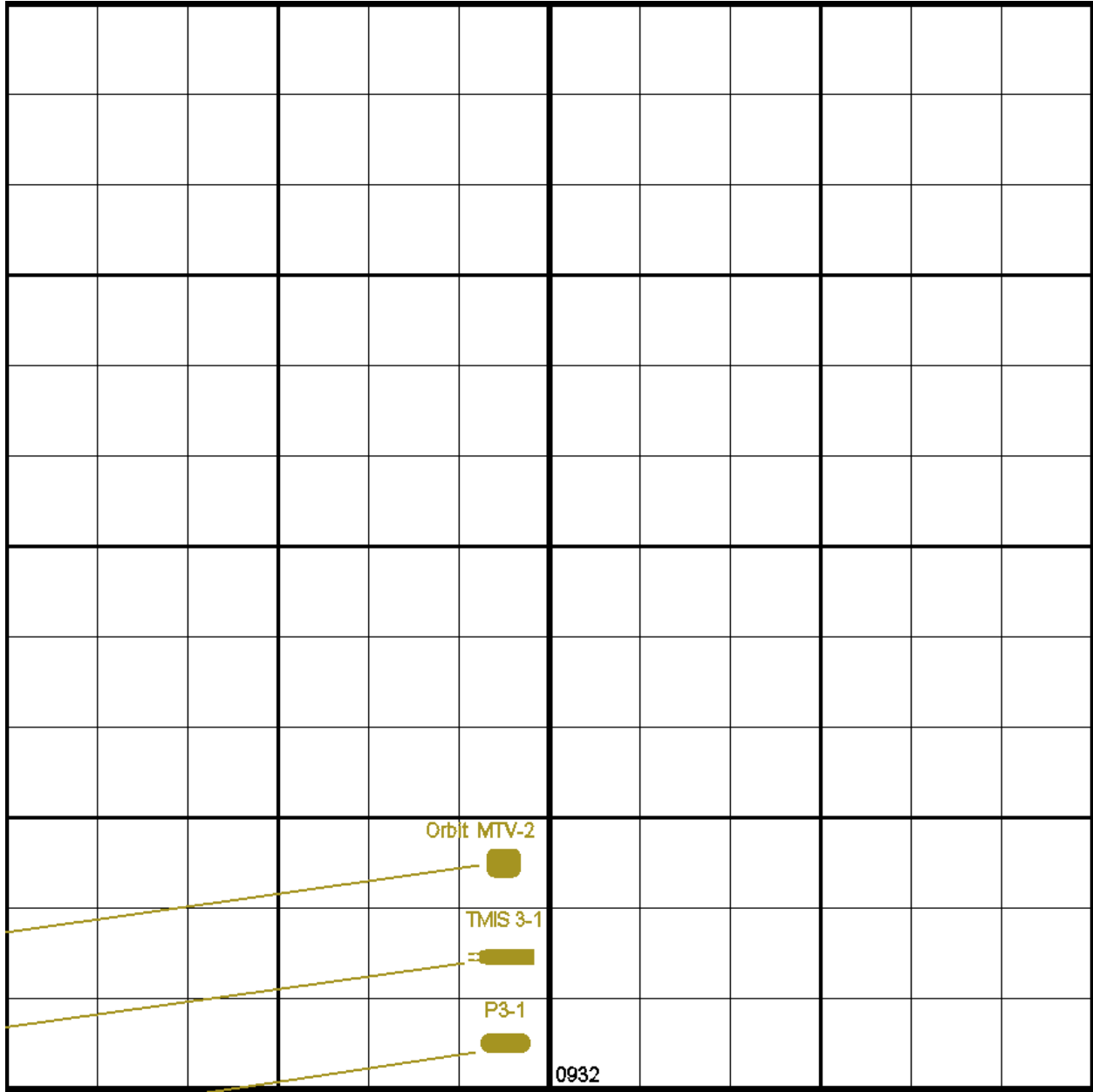


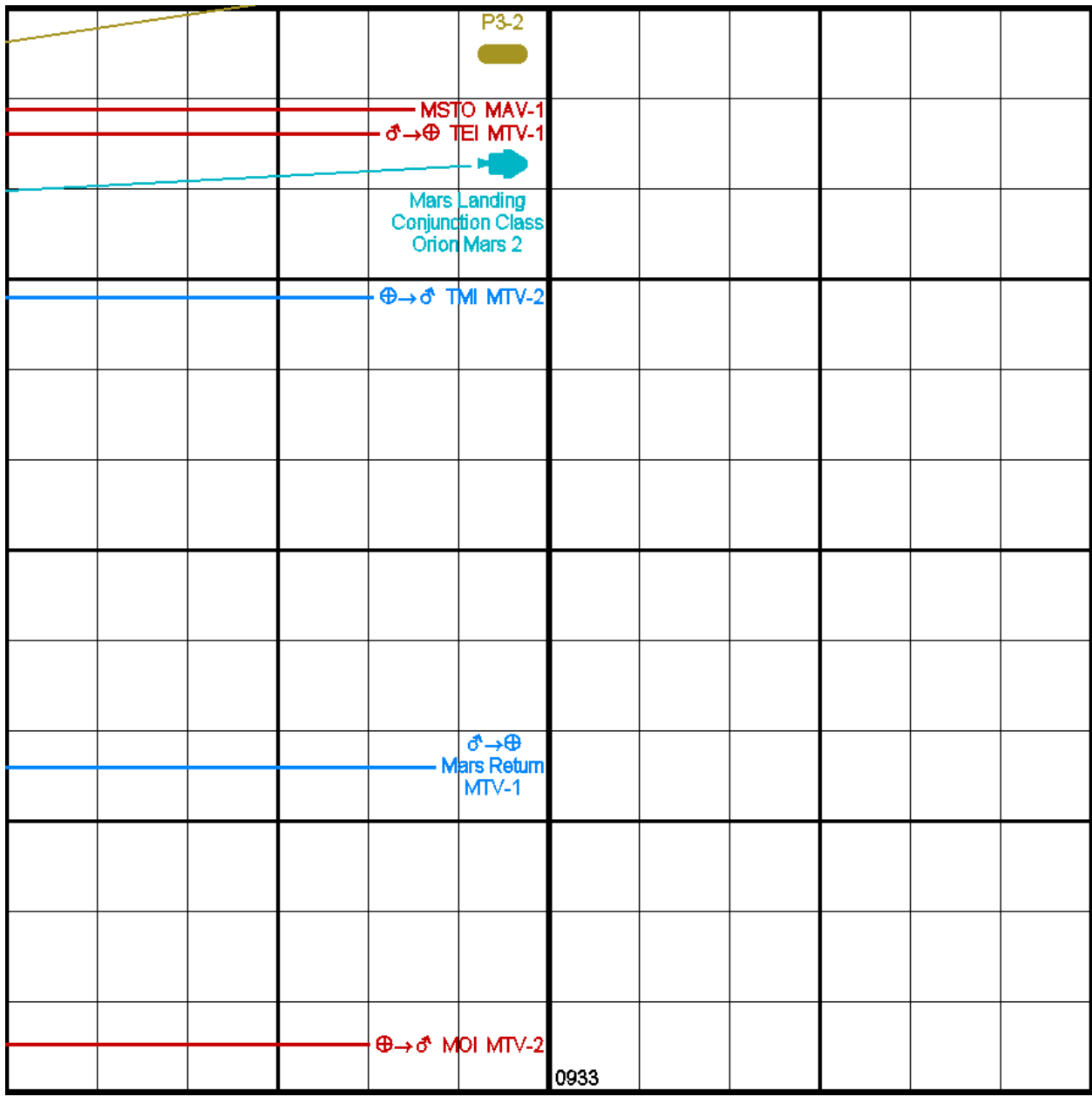












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