



NAVAL POSTGRADUATE SCHOOL

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THESIS

**HYPERDRIVE: PRACTICAL AND FUEL EFFICIENT
TRAVEL TO THE STARS (MODERN)**

by

Anakin Skywalker

June 2104

Thesis Advisor:
Second Reader:

Obi-Wan Knobi
Qui-Gon Jinn

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(MODERN)**

Anakin Skywalker
Padawan, Jedi Academy
B.S., University of BS, 2100
S.M., University of Service Marks, 2102

Submitted in partial fulfillment of the
requirements for the degree of

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**NAVAL POSTGRADUATE SCHOOL
June 2104**

Author: Anakin Skywalker

Approved by: Obi-Wan Knobi
Thesis Advisor

Qui-Gon Jinn
Second Reader

Yoda (Frank Oz)
Chair, Department of Force Sciences

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ABSTRACT

The idea of Hyperdrive relies on the existence of a separate and adjacent dimension most commonly called “hyperspace,” though various other names have been used: “Drivespace,” “The Immaterium,” “slipspace,” “Space2,” “subspace,” “Zero-space,” etc. When activated, the hyperdrive shunts the starship into this other dimension, where it can cover vast distances in an amount of time greatly reduced from the time it would take in “real” space. Once it reaches the point in hyperspace that corresponds to its destination in real space, it re-emerges. Usually, hyperdrive refers to a method of travel in which it takes a measurable amount of time to go from one point to another. When the distance is covered instantaneously, the term jump drive is often used.

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Faster-than-light travel is an important advance for the Jedi Academy. Although the work that I describe here is entirely my own, it is important for me to recognize the people who helped me reach where I am today. Grateful thanks are due to my thesis advisor, Obi-Wan Knobi, and my thesis reader, Qui-Gon Jinn. I am honored to be a Padawan, and I will never let you down.

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CHAPTER 1:

Hyperspace Characteristics

While in hyperspace, spaceships are typically isolated from the normal universe; they cannot communicate with nor perceive things in real space until they emerge. Often there can be no interaction between two ships even when both are in hyperspace. To people traveling in hyperspace, time typically moves at its normal pace, with little or no time dilation; 24 hours in hyperspace equates to 24 hours in real space. This is due to the fact that typical hyperdrive scenarios involve only changing the position of the craft, without altering its velocity (i.e., a ship will emerge with the same momentum, kinetic energy and direction of travel that it had upon entering hyperspace, thereby avoiding relativistic effects). One exception is David Brin's *Uplift Universe*; here, hyperspace is divided into "levels" where time passes at different rates. Hyperspace itself may be portrayed as swirling colors, total blackness, featureless gray, or as something that would drive a human mind insane should it be viewed. In much science fiction, hyperdrive jumps require a considerable amount of planning and calculation, with any error carrying a threat of dire consequences. Therefore, jumps may cover a much shorter distance than would actually be possible so that the navigator can stop to "look around"—take his bearings, plot position, and plan the next jump. The time it takes to travel in hyperspace also varies. Travel times may be in hours, days, weeks or more, and in those cases can provide a setting in itself for a story that takes place during an extremely long journey.

Hyperdrive is used extensively in the *StarWars* universe (Figure 1.1). Remember, in space no one can hear you scream.

1.1 Enhancing Drama

Hyperdrives allow for drama in science fiction by eliminating the single biggest problem with space as a setting for a story: the vast majority of space is empty and thus more or less uninteresting. As in most depictions of hyperspace, ships with hyperdrive can typically only interact with other ships while in "normal space," they would have to drop out of hyperspace to interact, and the chance of two ships appearing at the same location in deep space to take a navigation bearing at the same time is infinitesimal. Therefore, hyperdrive ships will encounter each other most often around contested planets or space stations, which can be light-years apart.

1.1.1 Dramatic Escapes

Hyperdrive may also allow for dramatic escapes as the pilot “jumps” to hyperspace in the midst of battle to avoid destruction. Dramatic tension can also be evoked by the use of “Jump Calculations” in the same way. “Will the computer or crew be able to calculate the needed equations before being sucked into a black hole or before a group of missiles hits the ship?” Hyperspace also provides the means by which the literally astronomical distances between stars can be traversed in such a way that would enable an author to have a plot that deals with multiple star systems in a reasonable amount of time, something generally impossible if speeds less than the speed of light are observed. Authors that write about interstellar cultures without hyperdrives generally wind up with plots that last for centuries or more, something not all authors are willing to do.

1.1.2 Some Fiction

In some science fiction, hyperspace travel is portrayed as potentially dangerous due to the chance that the route through hyperspace may take the ship too close to a celestial body with a large gravitational field, such as a star, or a black hole. In such scenarios, if a starship passes too close to a large gravitational field while in hyperspace, the ship is forcibly pulled out of hyperspace and reverts to normal space, or in some stories, is destroyed. Therefore, certain hyperspace “routes” may be mapped out that are safe, not passing too close to stars or other dangers. In some science-fiction universes, such as Star Wars, artificial gravity wells may be used to force another vessel to drop out of hyperspace. Other portrayals show less interaction between normal space and hyperspace, so that ships may actually pass through the position taken up by a celestial body in real space, without being affected. Given how critical transportation is to every human cultures without hyperdrives generally wind up with plots that last for centuries or more, something not all authors are willing to do.

1.1.3 More Fiction

In some science fiction, hyperspace travel is portrayed as potentially dangerous due to the chance that the route through hyperspace may take the ship too close to a celestial body with a large gravitational field, such as a star, or a black hole. In such scenarios, if a starship passes too close to a large gravitational field while in hyperspace, the ship is forcibly pulled out of hyperspace and reverts to normal space, or in some stories, is destroyed. Therefore, certain hyperspace “routes” may be mapped out that are safe, not passing too close to stars or other dangers. In some science-fiction universes, such as Star Wars, artificial gravity wells may be



Figure 1.1: The Star Wars logo; Wikipedia says that this is public domain.

used to force another vessel to drop out of hyperspace. Other portrayals show less interaction between normal space and hyperspace, so that ships may actually pass through the position taken up by a celestial body in real space, without being affected. Given how critical transportation is to every human culture, it is unsurprising that in an interstellar culture, which must deal with distances orders of magnitude greater than terrestrial cultures, the unique ways in which interstellar travel is described in various fictional universes tends to create major plot elements in that universe.

1.2 FTL

An FTL, or “Faster Than Light,” Drive is a fictional propulsion technology from the re-imagined *Battlestar Galactica* television series that allows space ships to achieve superluminal travel. They are fuelled by a refined version of the fictional ore *tylium* [?]. The verb *jump* is commonly used to describe the process of travelling via FTL drive. Dialogue states that the drive itself is “spun up” prior to use. The term FTL is never used in the original *Battlestar Galactica* film and television series. The term “light speed” is used, even though within the context of the storyline, the *Galactica* and its fleet move at sub-light speeds and are described as being unable to travel faster than light. The term FTL is also commonly used when the show is being discussed by outside parties.

1.2.1 Physics

The exact nature of the FTL drives remains unexplained in the show; what information exists has been extrapolated from visual behavior and on-screen dialogue. Little time appears to pass on a ship during a jump and objects within a ship do not appear to exhibit the signs of momentum/inertia associated with acceleration/deceleration. Nausea is a noticeable side effect noted

in some humans, for example Specialist Cally.

According to producer interviews in the season one DVD release of the series, the special effects director indicated that the FTL is a dimensional transport effect, where the ships instantaneously teleport from one place to another. This method of travel was one of several FTL ideas the production crew had in mind for the show, however to keep things simple and focused to the story, (as well as staying within budget restraints), producers David Eick and Ronald D. Moore chose the straightforward dimensional jump effect over more complex ideas. Because of this however, the term “FTL” used to describe this dimensional transition is somewhat misleading as the ships do not technically move faster than light, but rather instantaneously relocate to a new position in space without a change in speed. The fact remains, however, that they get to their destination faster than light would.

1.2.2 Navigation

Owing to difficulties navigating while using an FTL drive, ships wishing to make an FTL jump must calculate their speed, trajectory and jump duration prior to activating their FTL drive. Failure to do so can lead to ships jumping into poorly charted areas where sub-light navigation is difficult, or into dangerous areas such as those containing asteroid fields, gravity wells, or even inside a planet’s atmosphere. A ship making a properly calculated jump can arrive safely in planetary orbit, or alongside other ships or spaceborne objects. Ships using the same calculations can also safely jump together. Non-calculated jumps (known as a “blind jump”) are possible, as is risked by Admiral Cain aboard Pegasus during the Cylon sneak attack of the Scorpion Shipyards in the season two episode “Pegasus.” In “Razor,” Cain’s risky jump was shown in one of Kendra Shaw’s flashbacks—the ship jumped away just after undocking to the fleet-yard complex while under attack by Cylon Raiders. Because little is known about the physics of the FTL drive, it is not clear whether ships must plot a course around large physical objects, such as suns and gas giants, or if they have to adjust their course to take local gravitational variations into account, although the Galactica is shown in episode “Exodus” to be capable of making a successful jump whilst travelling through the atmosphere at immense speeds towards the surface of the planet New Caprica. Jump co-ordinates must be constantly updated to allow for changes in a ship’s position, and for stellar drift.

Large drives (fitted for example within a warship, such as a Battlestar and the larger civilian transports) allow them to travel greater distances than smaller craft, such as Raptors. A small ship, or ship with a less-capable FTL drive, must make several jumps in order to travel the same

Movie	Title
4	A New Hope
5	The Empire Strikes Back
6	Return of the Jedi

Table 1.1: The first set of movies. Remember, revenge is not the way of the Jedi.

Movie	Title
1	Something weird with Jar-Jar
2	I wish I could remember
3	This movie's name.

Table 1.2: The second set of movies.

distance as a larger ship. This approach can leave the craft vulnerable to detection or attack. Unlike Raptors, Vipers are not fitted with FTL drives. In order to initiate a jump, the crew must first initiate an automated start-up procedure, known as “spinning” the FTL drive, which can take several minutes to complete. This step is done just before a planned jump, presumably because it is impractical or impossible to keep the FTL drive in a “spun up” state of readiness for an extended period of time. The Cylons are capable of calculating more accurate jumps. In “Lay Down Your Burdens,” a Cylon Heavy Raider can make ten jumps in comparison to the *Galactica*’s 500 to jump to Caprica. Because of this, smaller Cylon ships (for example a Cylon Raider) can make longer jumps than Colonial craft of a similar size. The safe limit of FTL travel for the Twelve Colonies is known as the “Red Line.” A ship jumping beyond this line risks running into unknown navigational hazards, or going off course due to compound errors in its jump calculation. it Cylon technology

1.2.3 Cylon Technology

The Cylon FTL technology operated within the series is stated to be much more advanced than that operated by the Colonials, the superiority in FTL technology enables them to make much more accurate jumps of a longer range. Much like Colonial FTL technology the Cylons also make use of refined tylium ore as their fuel source. This advantage may lie primarily in the Cylon’s jump computers. Using a captured unit, a squad of *Galactica*’s Raptors were able to jump back to Caprica on a rescue mission in relatively few jumps. It is unclear whether this superior computing technology is solely responsible for the Cylon’s greater range, or if there is an additional advantage in drive technology itself.

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CHAPTER 2:

Dummy Chapter

2.1 Dummy Section1

2.2 Dummy Section2

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CHAPTER 3:

Another Dummy Chapter

3.1 Dummy Section 3

3.2 Dummy Section 4

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REFERENCES

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APPENDIX A:

My Favorite Foods

Jellybeans. Really.

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APPENDIX B:

Second Appendix

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Referenced Authors

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Initial Distribution List

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3. Marine Corps Representative
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