

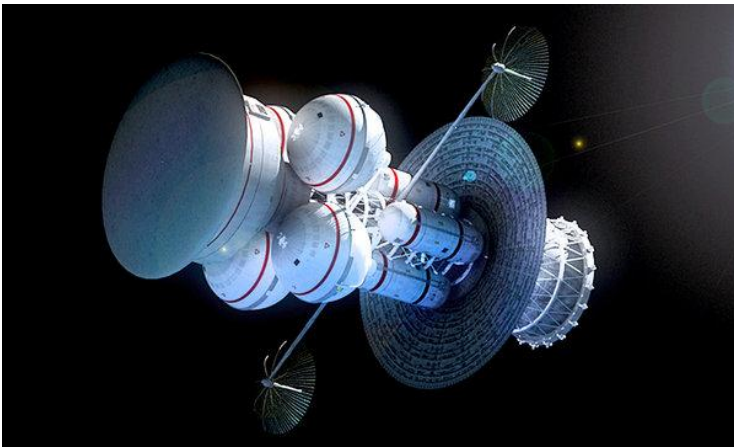
KINEMATICS

Unit 4 & 5 Dr. John P. Cise, Professor Of Physics, Austin Com. College

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Please send Dr Cise an e-mail on how you used this application. Thanks! Dr Cise

Not Such a Stretch to Reach for the Stars



CONCEPT An Icarus Interstellar design for an unmanned probe uses decades of technological advances to build on a 1970s British project called Daedalus.

INTRODUCTION: Alpha Centauri is the nearest Star to the sun at 4.37 light years.

QUESTIONS: (a) Find the distance to Alpha Centauri in miles? Note: A light year is the distance traveled by light in one year at 186,000 miles/s. (b) $10,000 \times 26,000 \text{ mph} = 260 \times 10^6 \text{ mph}$. At that speed how long would it take to get to Alpha Centauri in years? (c) Traveling at 10% speed of light (18,600 mi./s or $67 \times 10^6 \text{ mi./hr.}$) how long would it take to get to Alpha Centauri?

HINTS: $x = vt$, 365 days/yr., 24 hrs./day, 3600 s/hr.

ANSWERS: (a) $\sim 2.56 \times 10^{13}$ miles

(b) ~ 11.26 years

(c) ~ 43.7 years

It may seem a fantastical notion, but hardly more so than the idea of building a starship of any kind, especially with [NASA's](#) future uncertain at best. Yet here in Orlando, not far from the launching site of the space program's most triumphant achievements, the **government's Defense Advanced Research Projects Agency, or Darpa**, drew hundreds this month to a symposium on the 100-Year Starship Study, which is devoted to ideas for visiting the stars. Participants — an eclectic mix of engineers, scientists, science fiction fans, students and dreamers — explored a mix of ideas, including how to organize and finance a century-long project; whether civilization would survive, because an engine to propel a starship could also be used for a weapon to obliterate the planet; and whether people need to go along for the trip. (Alternatively, machines could build humans at the destination, perhaps tweaked to live in non-Earth-like environs.) **"The space program, any space program, needs a dream," said one participant, Joseph Breeden. "If there are no dreamers, we'll never get anywhere."**

It was Dr. Breeden who offered the idea of an engineless starship. A physicist by training, he had most recently devised equations that forecast to banks how much they were going to lose on their consumer loans.

From his doctoral thesis, Dr. Breeden remembered that in a chaotic gravitational dance, stars are sometimes ejected at high speeds. The same effect, he believes, could propel starships. First, find an asteroid in an elliptical orbit that passes close to the Sun. Second, put a starship in orbit around the asteroid. If the asteroid could be captured into a new orbit

that clings close to the Sun, **((((the starship would be flung on an interstellar trajectory, perhaps up to a tenth of the speed of light.)))))** "The chaotic dynamics of those two allow all the energy of one to be transferred to the other," said Dr. Breeden, who came toting copies of a paper describing the technique. "It's a unique type of gravity assist."

Another way of looking at the challenge is that in 10,000 years, the speed of humans has jumped by a factor of about 10,000, from a stroll (2.6 m.p.h.) to the **((((Apollo astronauts' return from the Moon (26,000 m.p.h.). Reaching the nearest stars in reasonable time — decades, not centuries — would require a velocity jump of another factor of 10,000.)))))**