Amateur Radio Satellites

Don Ferguson
KD6IRE
Prof Steve Petersen
AC6P

November 2005

Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

Project OSCAR

- Designed / built OSCAR 1 – 4
- Air Force launch from Vandenberg

  Dec. 12th 1961 OSCAR 1 * * * * * * *

- Setup a world wide monitoring network of Hams

  570 Amateurs in 28 countries reported receiving OSCAR 1

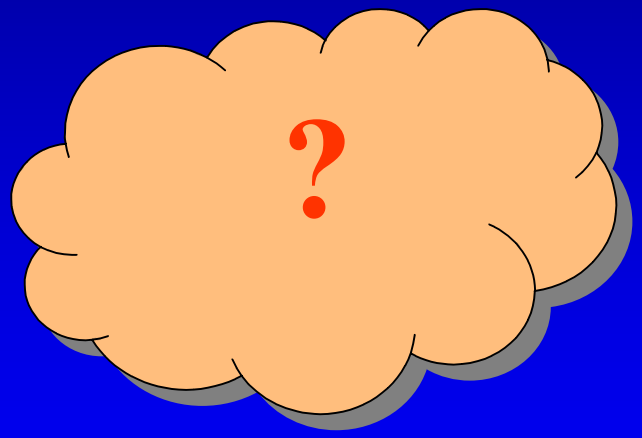
Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

created using
BCL easyPDF
Printer Driver

Satellites ????? - The basics

- What makes something a satellite?

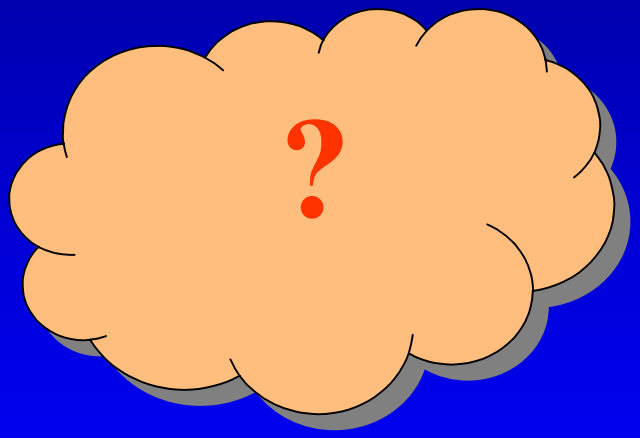


Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

Satellites ????? - The basics

- Are all satellites in similar orbits?



Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

Satellites ????? - The basics

- **Are all satellites in similar orbits?**

  NO

  - **LEOS**
  - **GEOS**
  - **Elliptical**
  - **Circular**

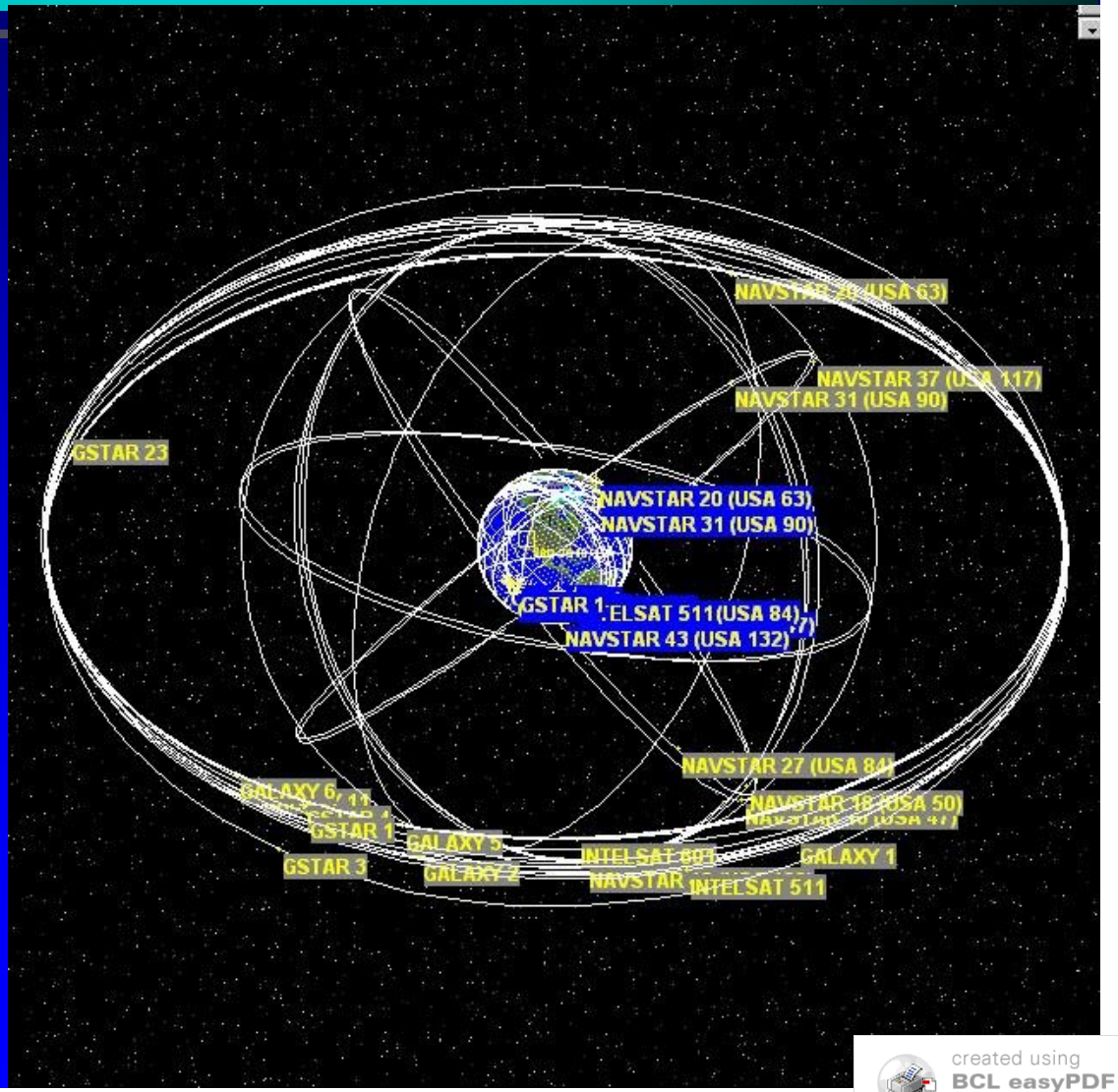
Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

Satellite Orbits

GPS satellites on inner Orbits, Geosynchronous satellites on outer rings.

This View is centered on San Jose CA



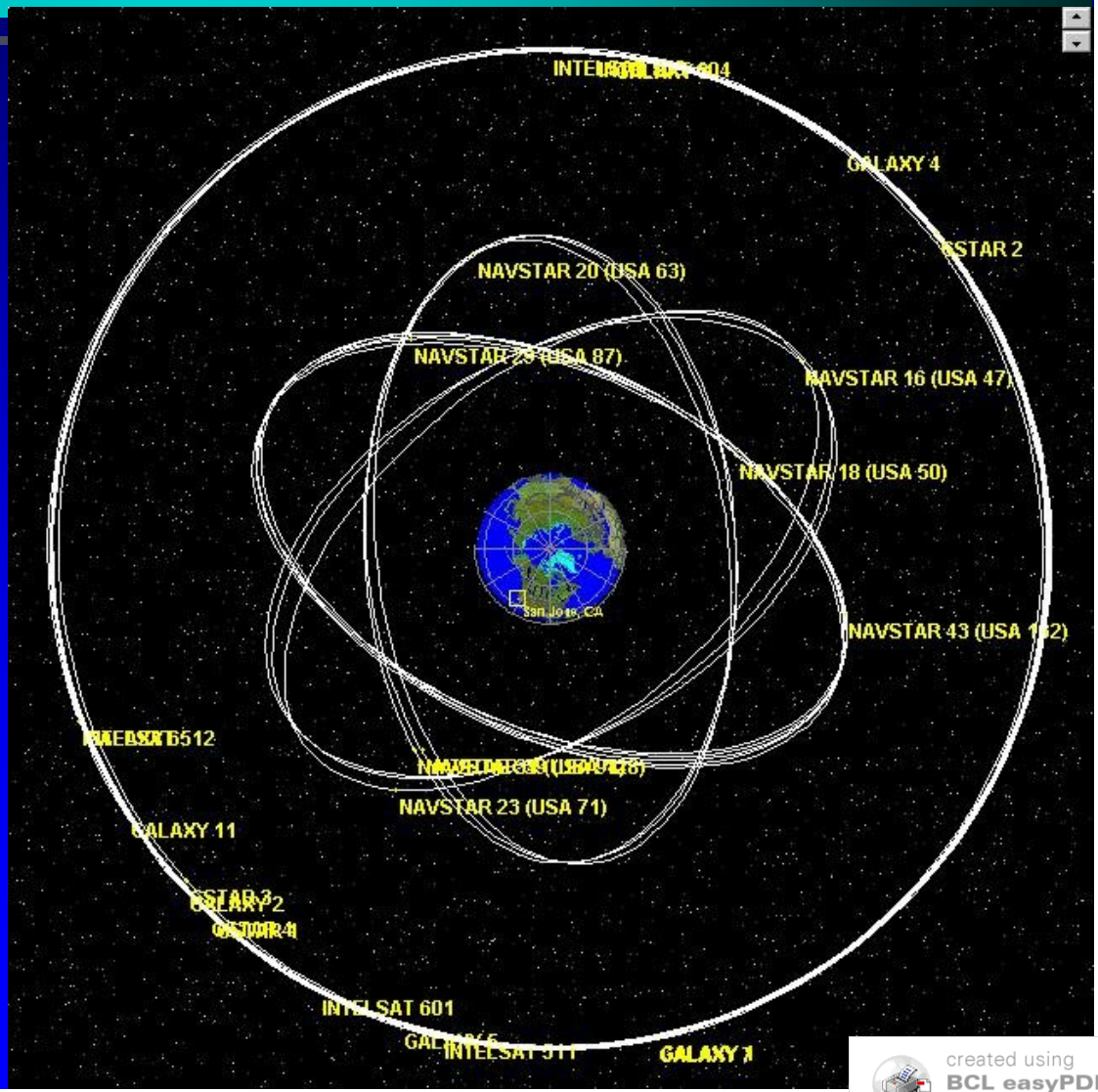
created using
BCL easyPDF
Printer Driver

Satellite Orbits

GPS satellites on Inner orbits with *Geosynchronous* satellites on outer rings.

This View is centered on The North Pole

GPS = 12,500 mi 8600 mph
Geo = 22,200 mi 6855 mph

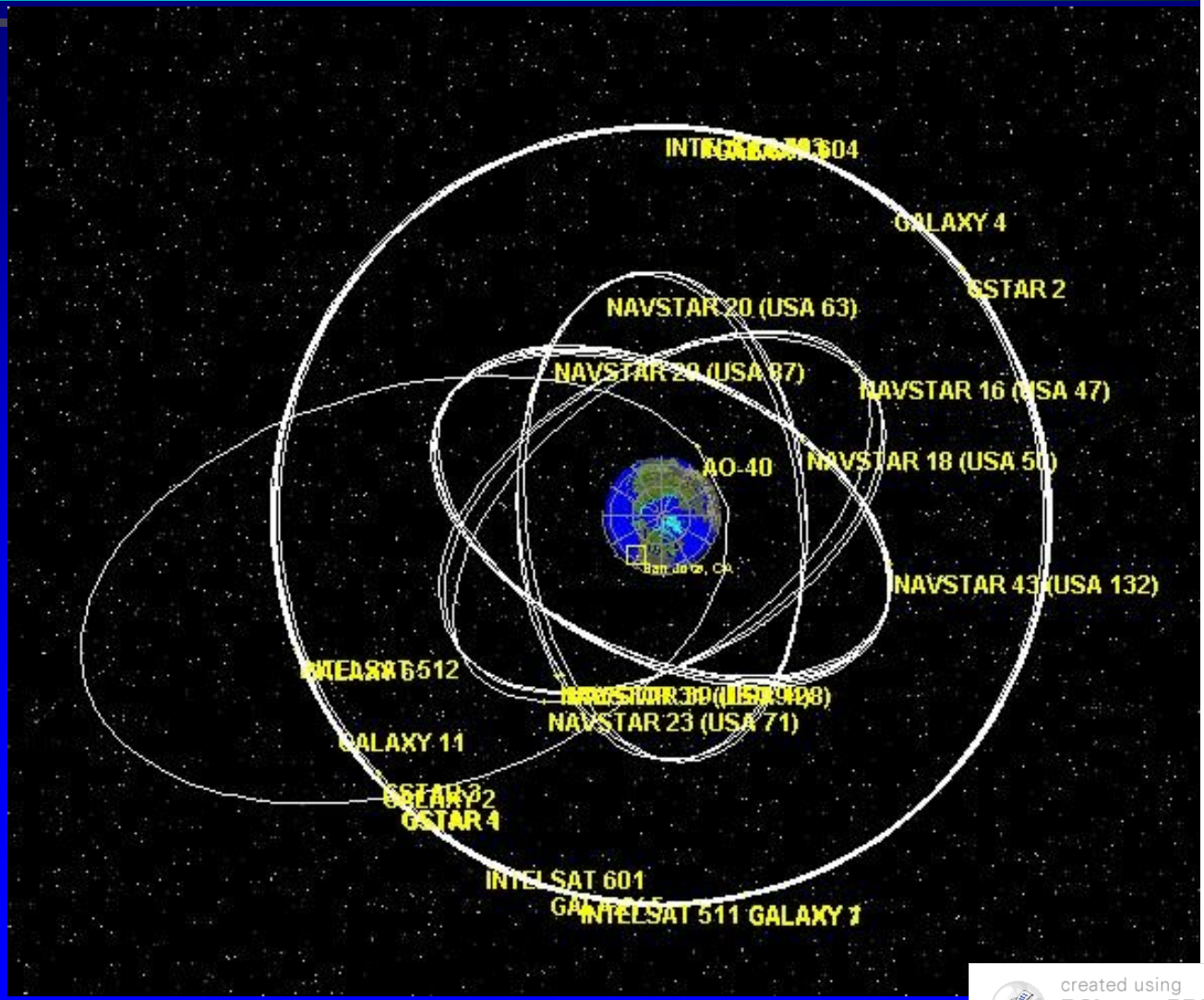


created using
BCL easyPDF
Printer Driver

Satellite Orbits

GPS, Geostationary, and Amateur satellites.

This View is centered on The North Pole



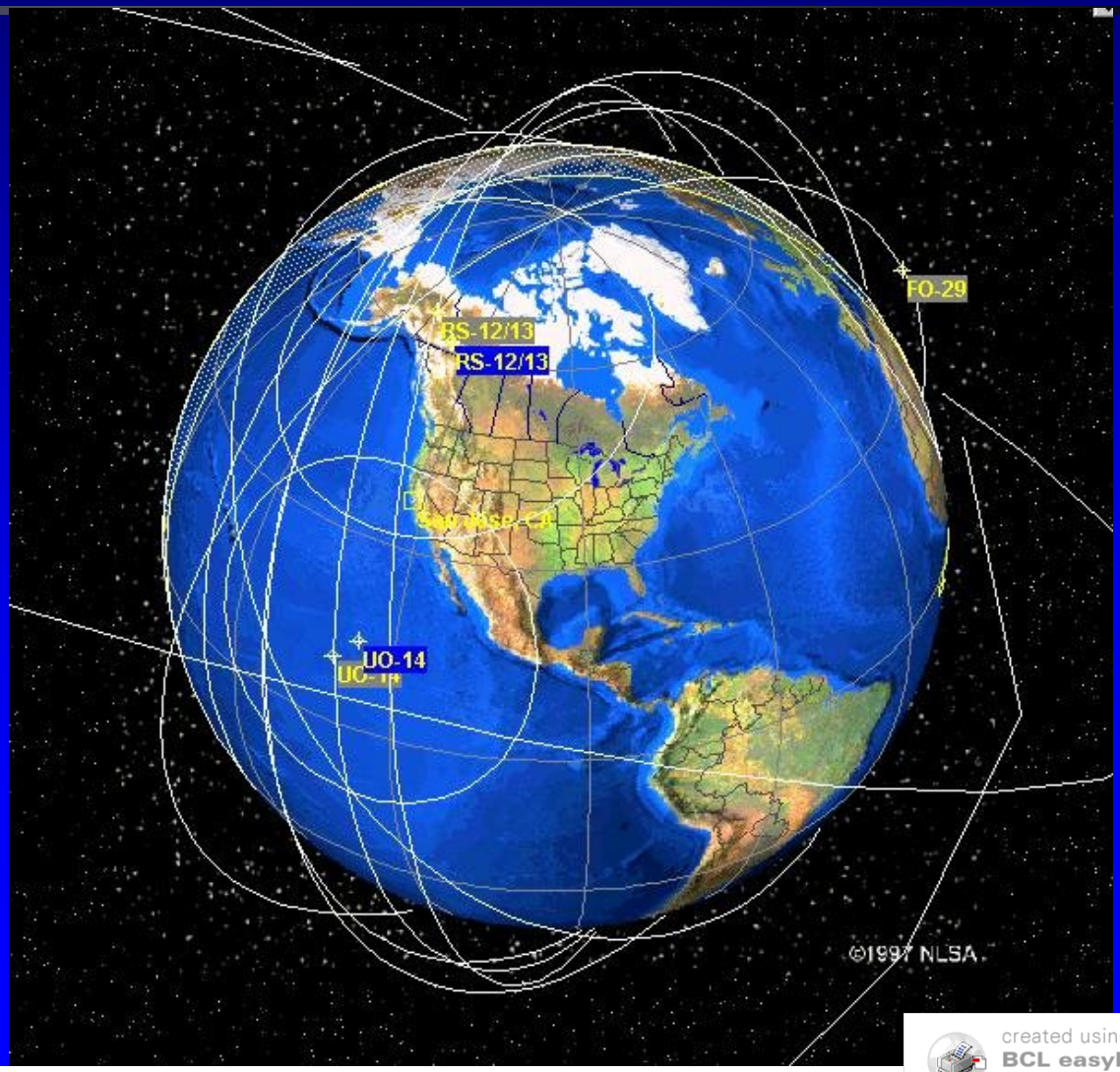
created using
BCL easyPDF
Printer Driver

Satellite Orbits

LEOs,
Low Earth Orbit
Amateur satellites.

This View is centered on North America

FO20
LEO = 652 mi 16195mph
ISS = 220 mi 17747mph



created using
BCL easyPDF
Printer Driver

Transmission Modes

- Analog SV's
  - FM - AO27, AO-50, AO-51 & ISS
    436.800 fm ↓ / 145.850 fm
  - CW – AO-7, FO-29, VO-52
  - SSB – AO-7, FO-29 & VO-52
    435.860 usb ↓ / 145.950 lsb - inverted
- Digital SV's
  - Packet (AFSK) / APRS
  - PSK

Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

Tuning and Tracking

- Doppler Shift
  - Measure the beacon
  - Calculate based on band
    - VHF = +- 3 khz UHF = +- 9 khz
    - 2.4ghz = +- 50 khz
- AZ-EL Antenna control
  - Computer controlled

Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver

How do we calculate doppler shift?

For light or other electromagnetic radiation, the prediction would be

$$f'/f = \frac{c}{(c+v)}$$

where *c* is the speed of light. This is the default Prediction when we assume that lightspeed is fixed in the observer's frame

Copyright © Project Oscar Inc, 2005 - All Rights Reserved

created using
BCL easyPDF
Printer Driver