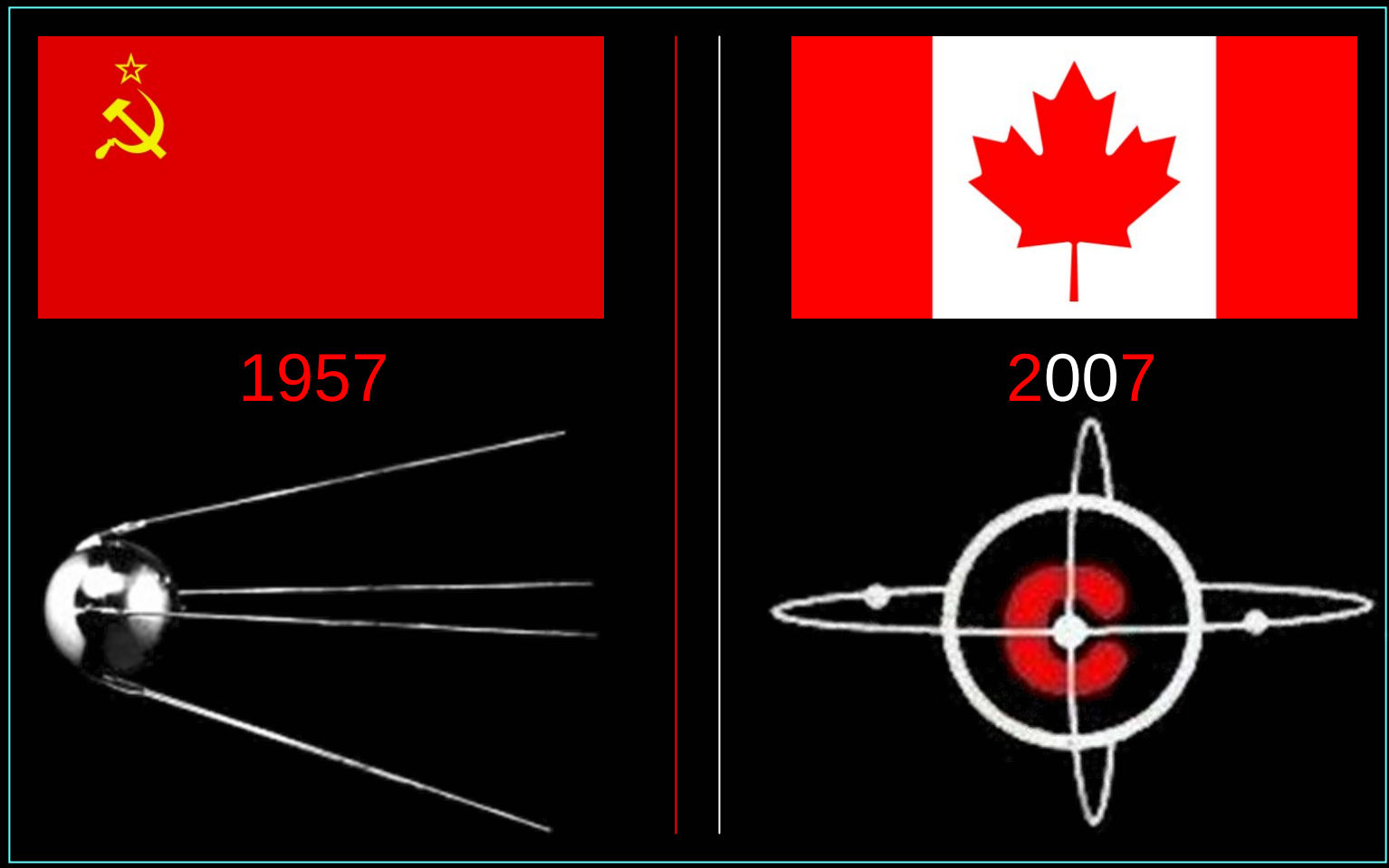
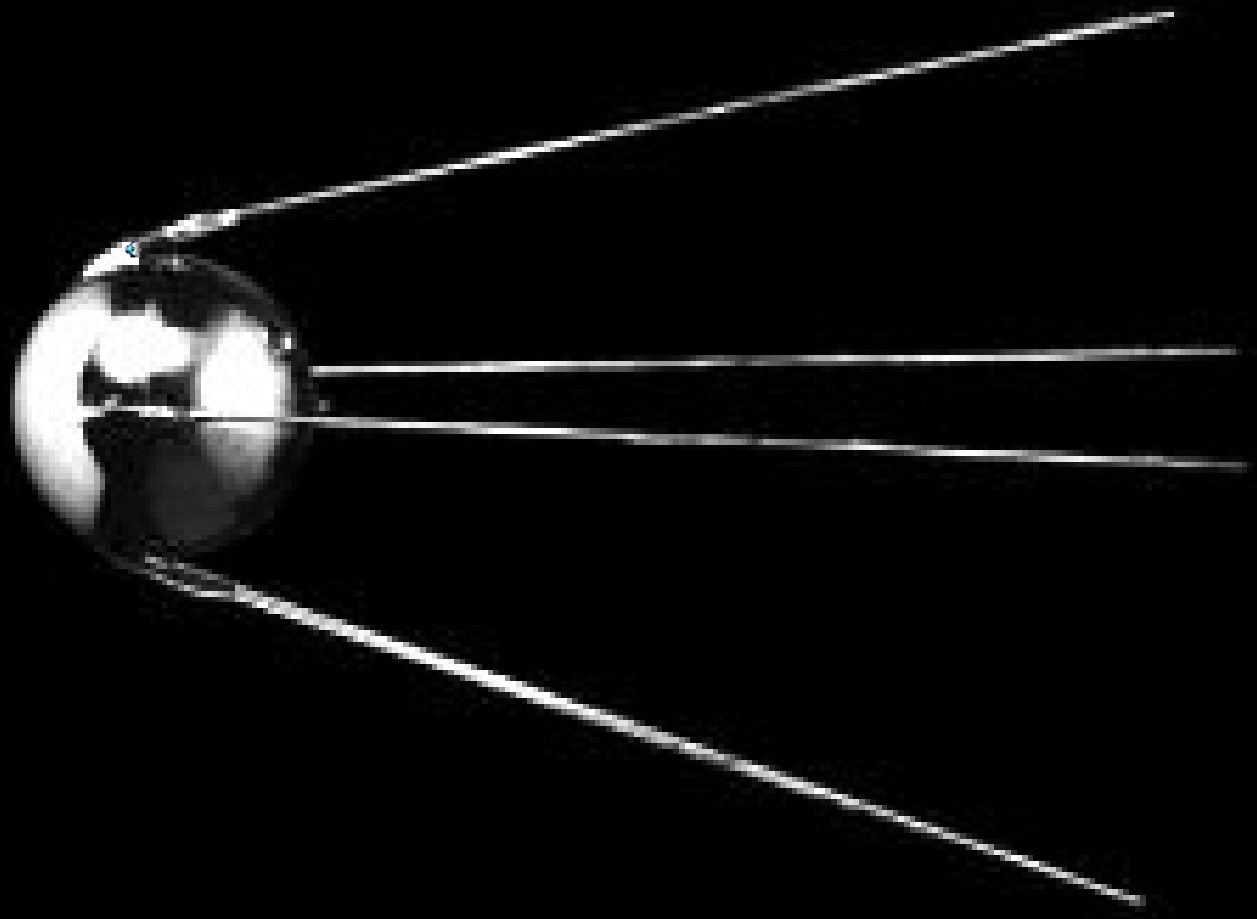
CASTOR'S "SPUTNIK 50TH ANNIVERSARY SATELLITE TRACKING BONANZA"



MICHAEL A. EARL

CANADIAN SATELLITE TRACKING & ORBIT RESEARCH



"All the News That's Fit to Print"

The New York Times.

LATE CITY EDITION

NEW YORK, SATURDAY, OCTOBER 5, 1957.

FIVE CENTS

SOVIET FIRES EARTH SATELLITE INTO SPACE; IT IS CIRCLING THE GLOBE AT 18,000 M. P. H.; SPHERE TRACKED IN 4 CROSSINGS OVER U. S.

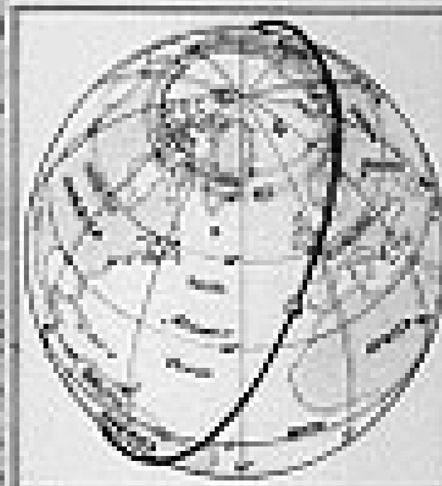
HOFFA IS ELECTED TEAMSTERS' HEAD; WARNS OF BATTLE

Defeats Two Foes 3 to 1 —Says Union Will Fight 'With Every Ounce'

IN TOKEN OF VICTORY:

COURSE RECORDED

Navy Picks Up Radio Signals—4 Report Sighting Device



Device Is 8 Times Heavier Than One Planned by U.S.

560 MILES HIGH

Visible With Simple Binoculars, Moscow Statement Says

FAUBUS COMPARES HIS STAND TO LEE'S

Flu Widens in City; 10% Rate Predicted; 200,000 Pupils Out

ARGENTINA TAKES EMERGENCY STEPS

SATELLITE SIGNAL

4 OCTOBER
1957

SPUTNIK ORBITING THE EARTH

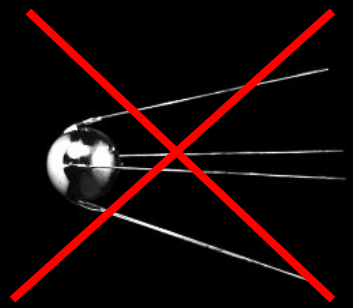
THE FIRST-EVER SOVIET ARTIFICIAL SATELLITE OF THE EARTH

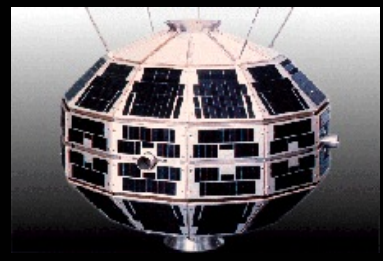
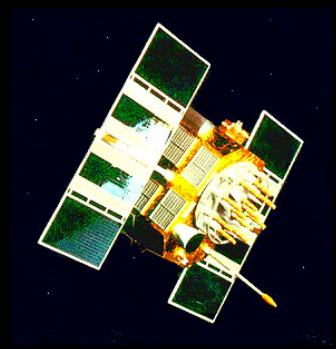
USSR "SPUTNIK" STAMP

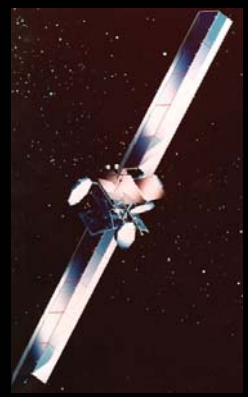

5 Oct 1957 05:30:00.00

THE "SPUTNIK 50TH ANNIVERSARY SATELLITE TRACKING BONANZA"

TO OPTICALLY DETECT AND TRACK 1,957 (OR MORE) UNIQUE ARTIFICIAL SATELLITES TO CELEBRATE SPUTNIK'S 50TH ANNIVERSARY AND 50 YEARS OF SATELLITE TRACKING



WHY IS CASTOR DOING THIS?

TO CELEBRATE 50 YEARS OF SATELLITES AND SATELLITE TRACKING;

TO CONDUCT SURVEYS OF THE ACCESSIBLE CROSS-SECTION OF THE CURRENT SATELLITE POPULATION;

TO EDUCATE THE GENERAL PUBLIC ABOUT THE VAST SATELLITE INFRASTRUCTURE ORBITING US;

TO POTENTIALLY OFFER ITS SERVICES AND DATA TO SATELLITE COMPANIES WHO WISH AN ALTERNATIVE TO HIGH-COST SATELLITE TRACKING METHODS;

AND…

ITS FUN!!!!

CASTOR TRACKING EQUIPMENT

Celestron “NexStar 11 GPS” 11-Inch Aperture Schmidt-Cassegrain Telescope;

Celestron “NexStar 8i Special Edition” 8-inch Aperture Schmidt-Cassegrain Telescope;

Ricoh “Rikenon” 50mm SLR Camera Lens (30mm Aperture, f/4);

SBIG “ST-9XE” CCD Camera;

Timex “Triathlon” Precision Stopwatch;

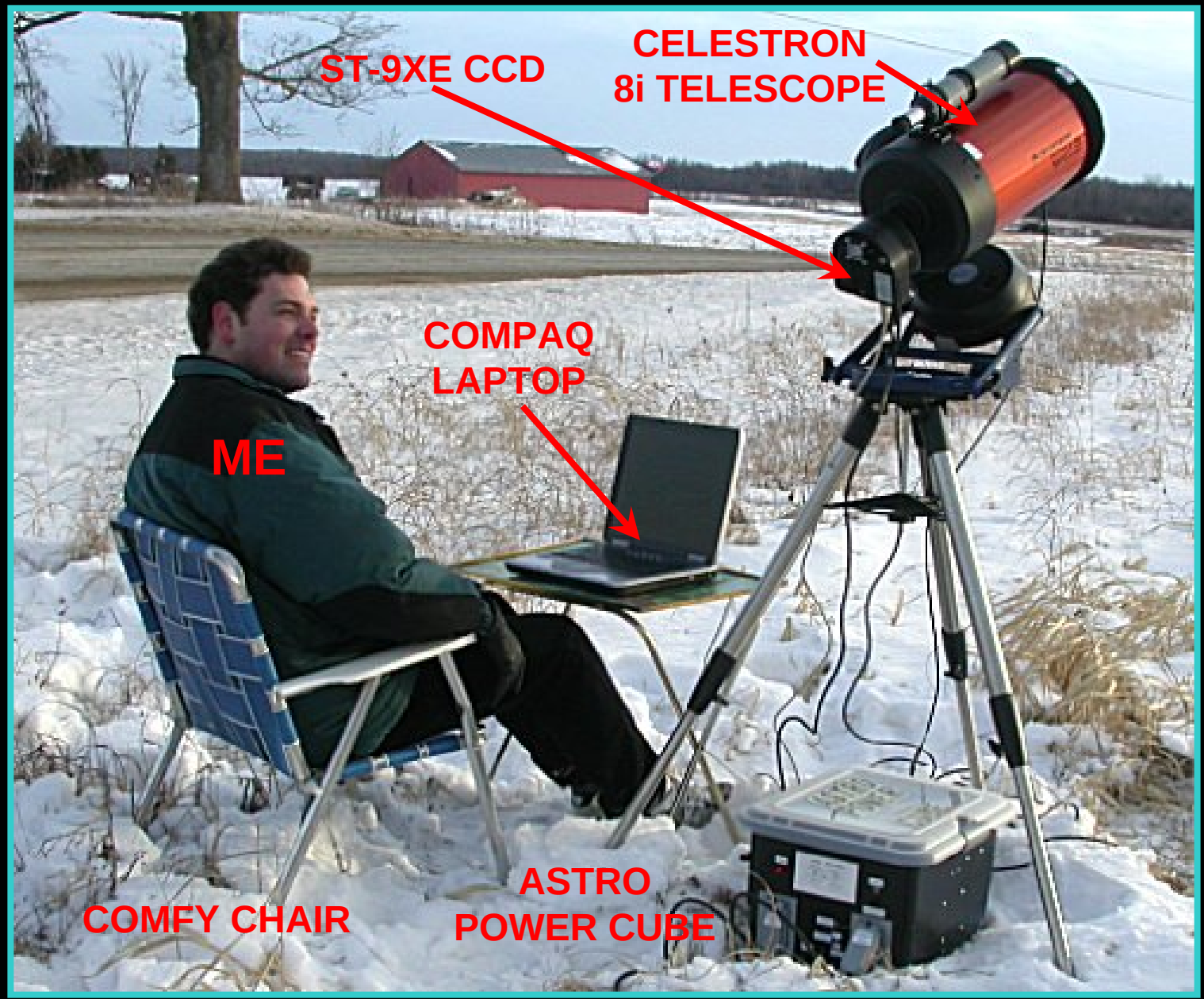
JVC Shortwave Radio (CHU or WWV);

Software Bisque’s “TheSky” Astronomy Software (Satellite Orbit Propagation Tool);

Software Bisque’s “CCDSoft” Camera Control and Image Analysis Software; and

AGI “Satellite Tool Kit” (STK).

THE "CASTOR WIDE FIELD" CAMERA



THE “CASTOR JUNIOR” FACILITY

THE "CASTOR" FACILITY

TRACKING LOCATIONS

Main Site: Brockville, Ontario (-75^{o} 41’ 16” +44^{o} 35’ 25”)

Secondary Site: Kemptville, Ontario (-75^{o} 38’ 53” +45^{o} 00’ 57”)

Tertiary Site: Orleans (East Ottawa), Ontario (-75^{o} 32’ 11” +45^{o} 28’ 27”)

Other Sites: Canada Science and Technology Museum, Ottawa; Mill of Kintail Conservation Area, Almonte; Glengarry Stargazers Astronomy Club

LOW EARTH ORBIT (LEO)

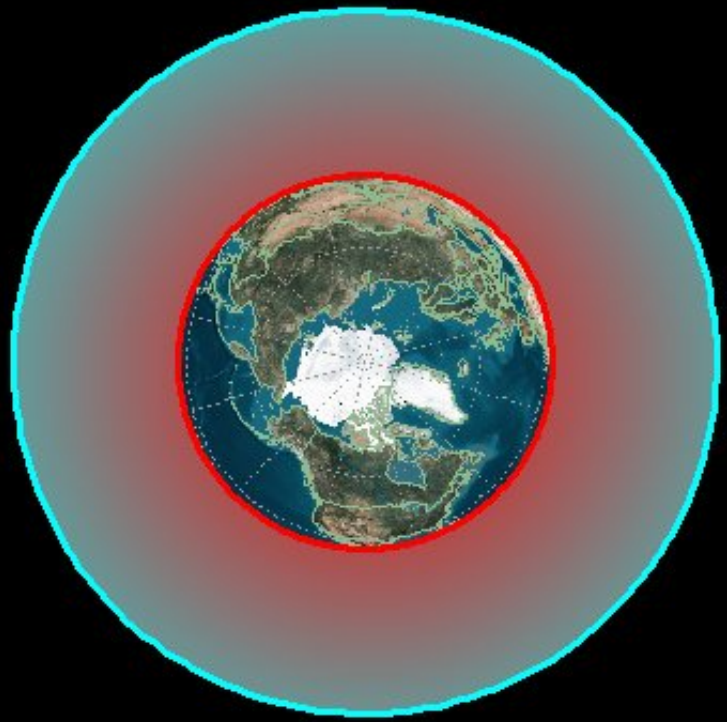
AVERAGE ORBIT HEIGHT: 200 TO 6,000 KILOMETRES

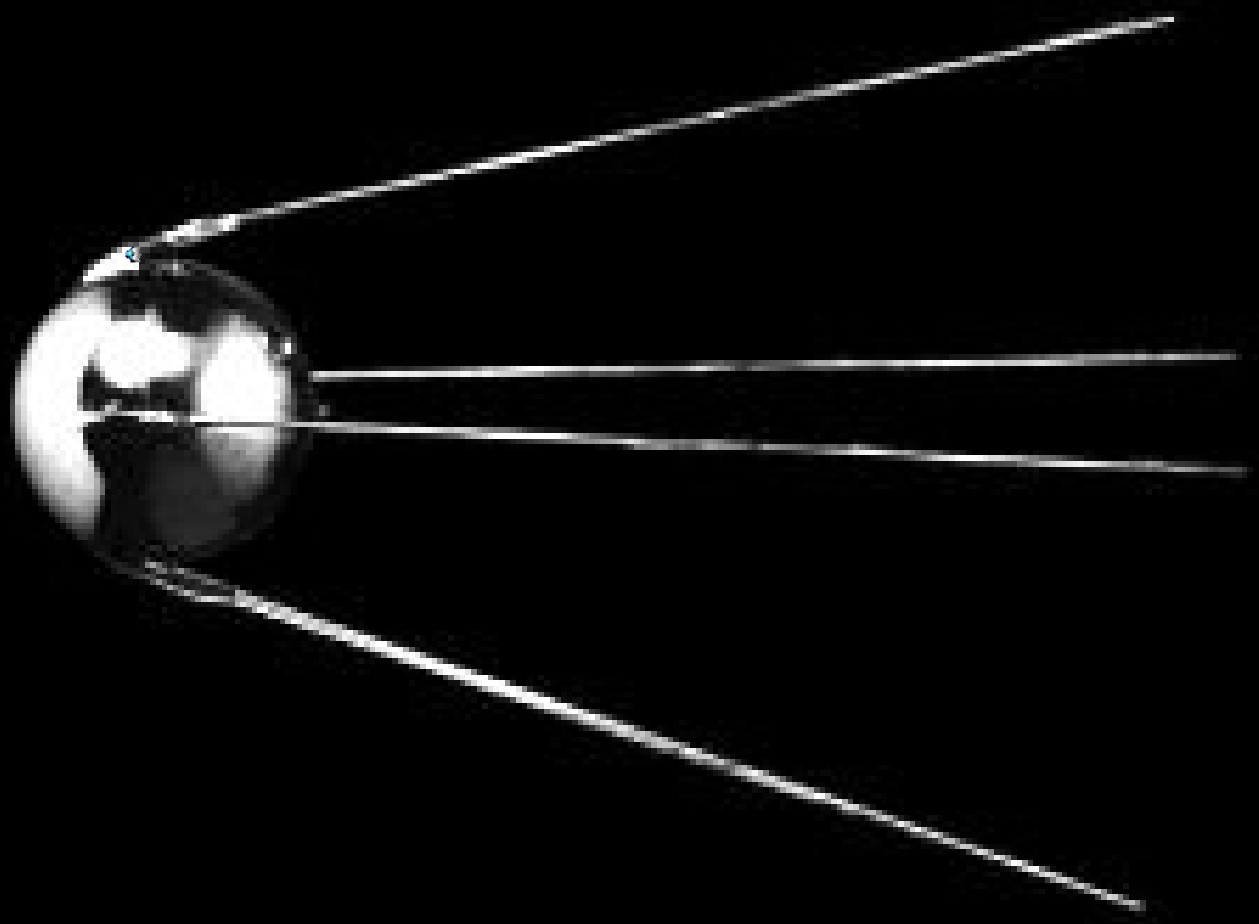
ORBIT PERIOD: 1.5 TO 4 HOURS

ORBITS PER DAY: 16 TO 6

NUMBER OF SATELLITES IN LEO ORBIT: 8,400 (MOST WITHIN 1,000 KM ORBIT HEIGHT)

EXAMPLES: SPUTNIK, EXPLORER, VANGUARD, ALL MANNED SPACE FLIGHTS (EXCEPT APOLLO), HUBBLE, INTERNATIONAL SPACE STATION, ALOUETTE, RADARSAT, MOST

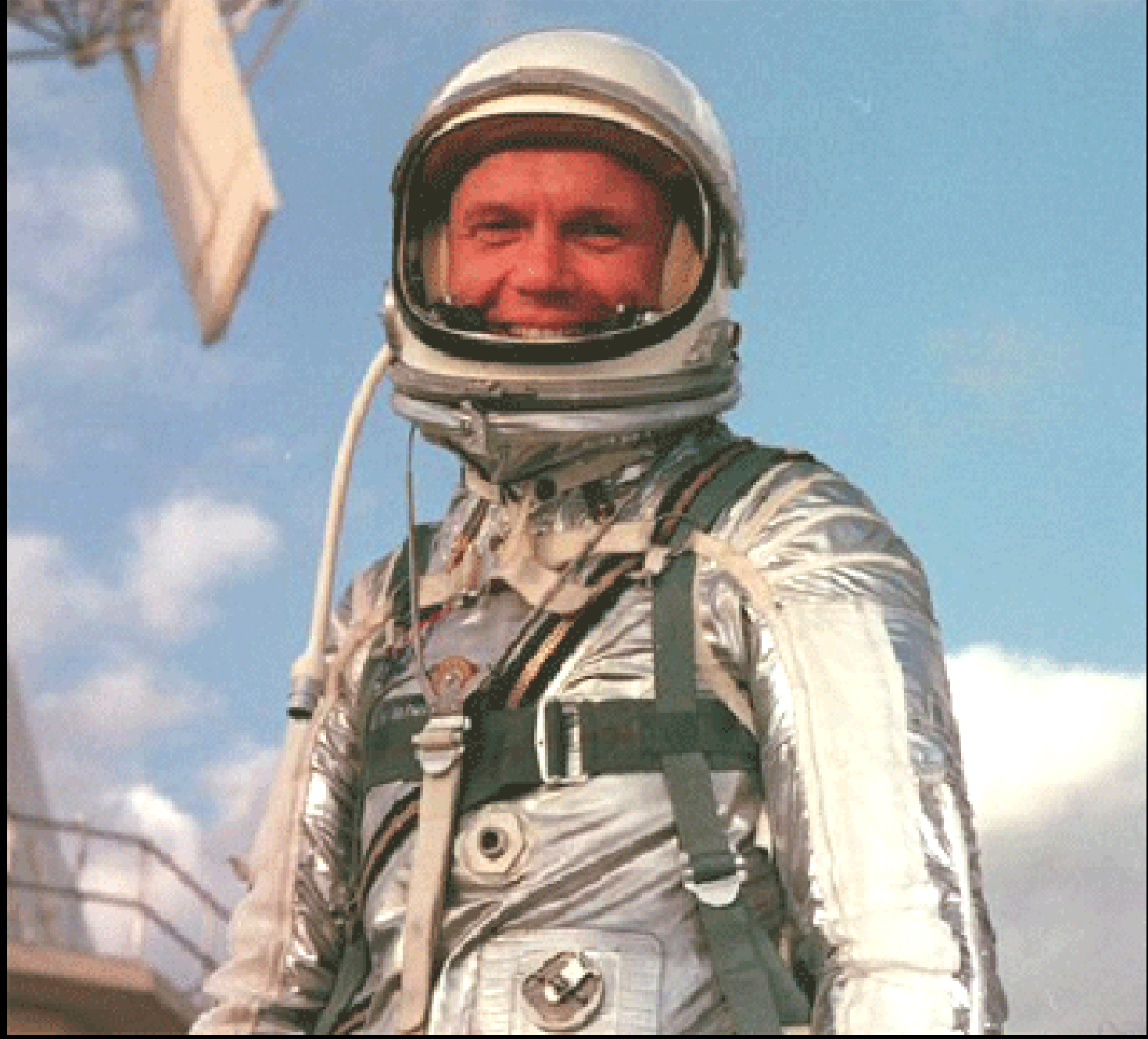




THE FIRST SATELLITE

THE FIRST LIVING SATELLITE

THE FIRST HUMAN SATELLITE



THE FIRST (AMERICAN) HUMAN SATELLITE

THE FIRST SATELLITE TV TRANSMISSION

SATELLITE IMAGERY

SATELLITE COMMUNICATIONS

SPACE INHABITANCE

MID EARTH ORBIT (MEO)

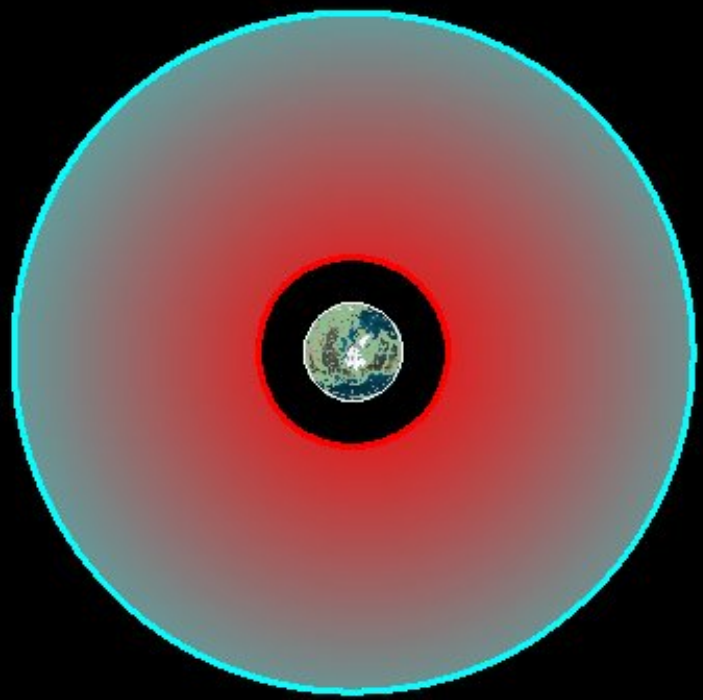
AVERAGE ORBIT HEIGHT: 6,000 TO 35,600 KILOMETRES

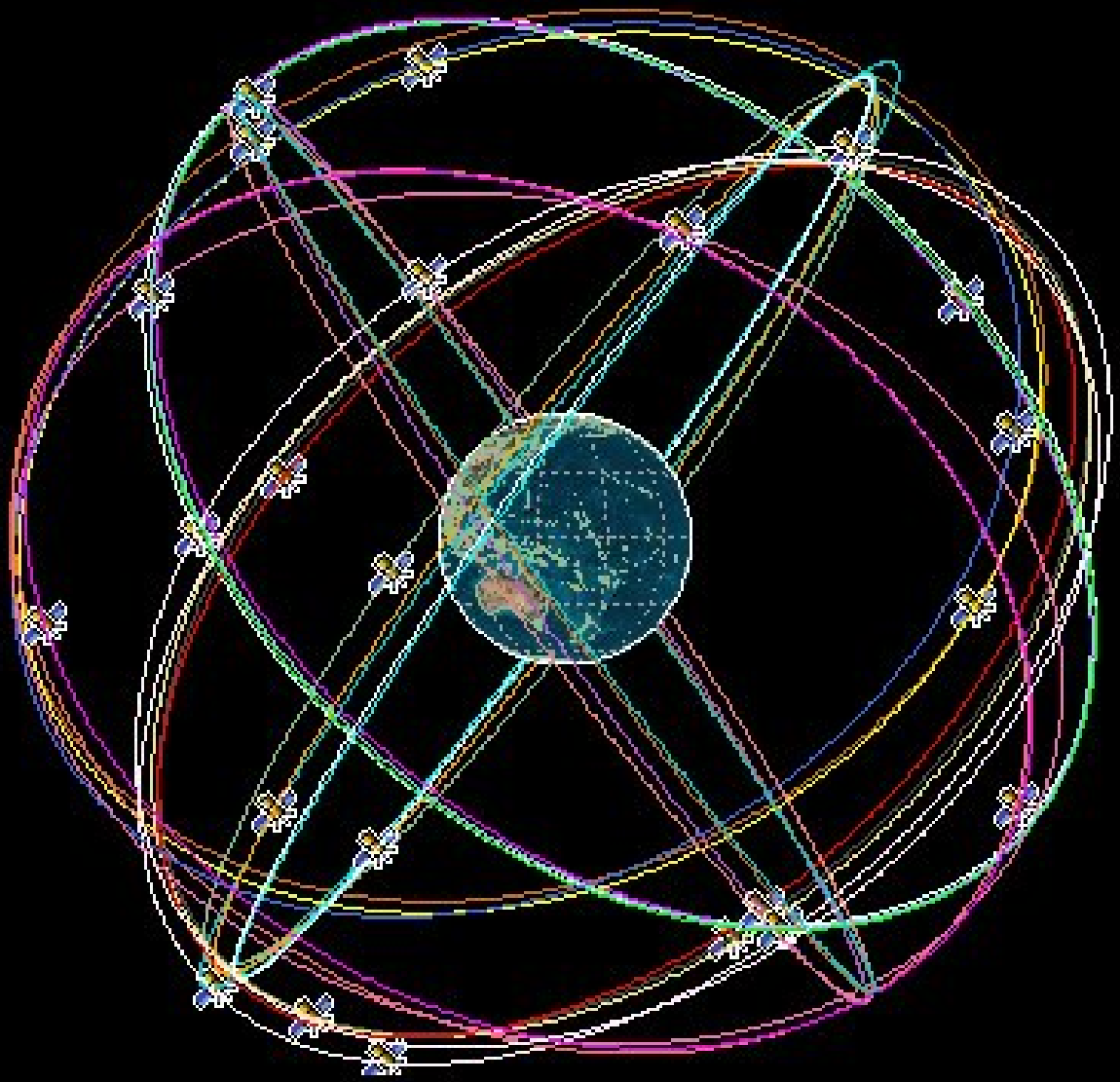
ORBIT PERIOD: 4 TO 24 HOURS

ORBITS PER DAY: 6 TO 1

NUMBER OF SATELLITES IN MEO ORBIT: 1,700

EXAMPLES: VANGUARD 1, 2 & 3, TELSTAR 1 & 2, MOLNIYA, GPS





GPS SATELLITE CONSTELLATION

GPS RECEIVER

GEOSYNCHRONOUS ORBIT (GEO)

AVERAGE ORBIT HEIGHT: 35,600 KILOMETRES

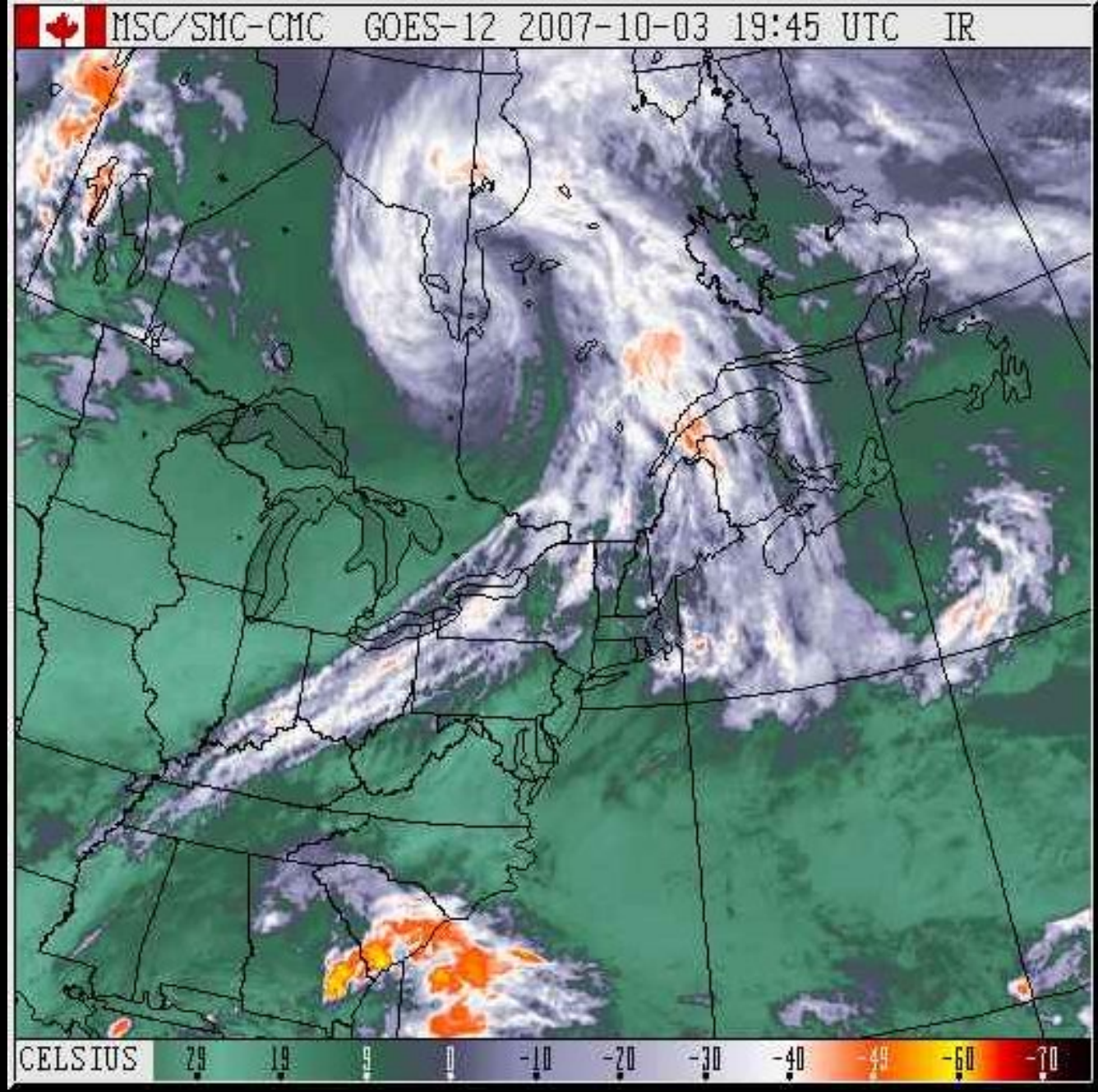
ORBIT PERIOD: ~24 HOURS

ORBITS PER DAY: ~1

NUMBER OF SATELLITES IN GEO ORBIT: 900

EXAMPLES: ANIK, NIMIQ, DIRECTV, GALAXY, ECHOSTAR, XM, SIRIUS

GEOSTATIONARY SATELLITE DISHES



GEOSTATIONARY SATELLITE WEATHER IMAGE

GEOSTATIONARY SATELLITE TRANSMISSION

HIGH EARTH ORBIT (HEO)

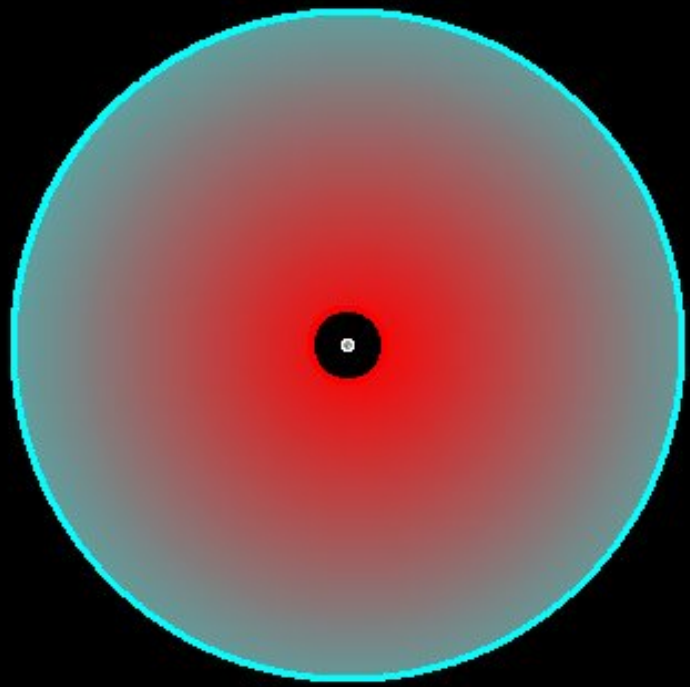
AVERAGE ORBIT HEIGHT: 35,600 TO INFINITE KILOMETRES ABOVE EARTH

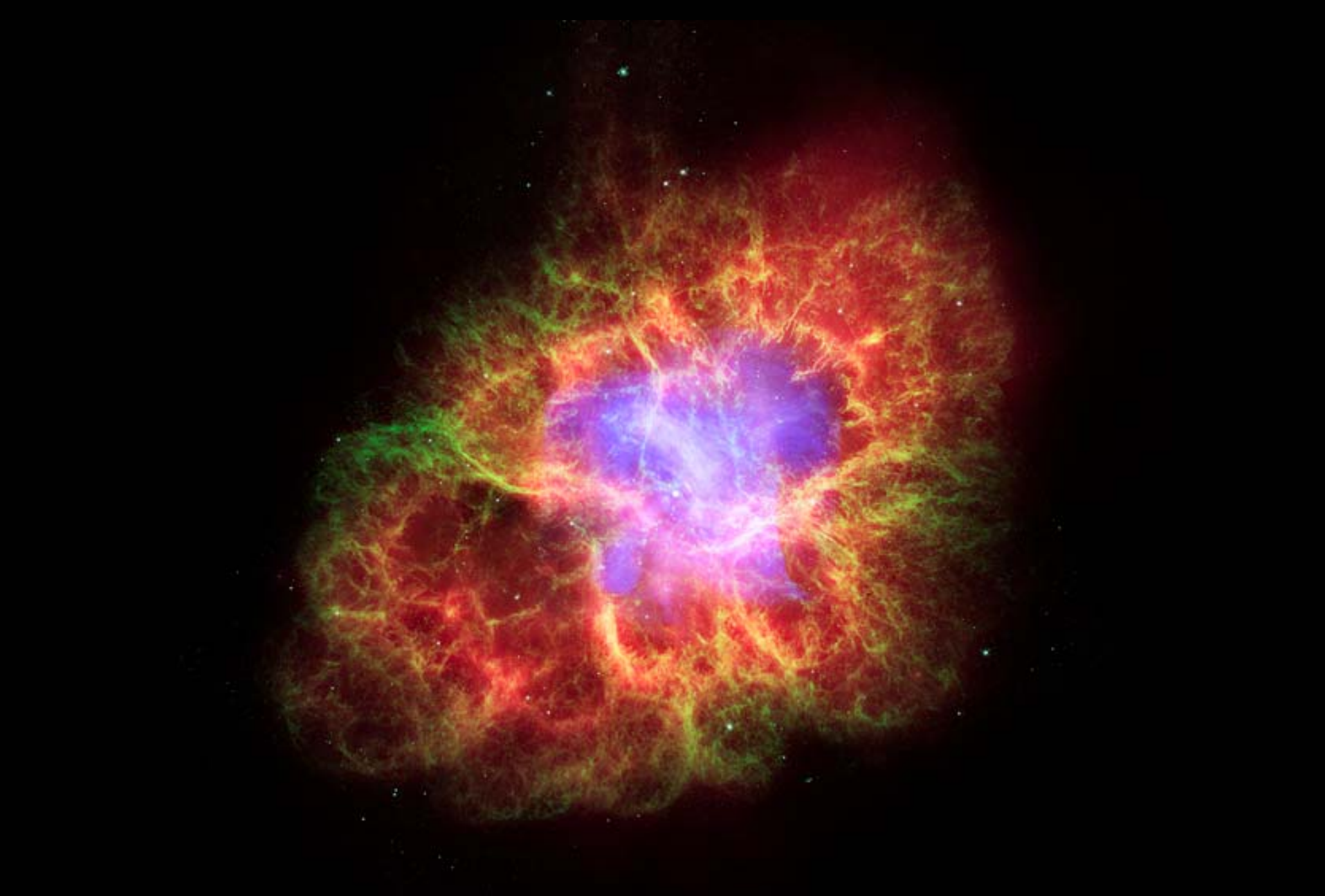
ORBIT PERIOD: BETWEEN 24 HOURS AND INFINITY

ORBITS PER DAY: BETWEEN 1 AND 0

NUMBER OF SATELLITES IN HEO ORBIT: 30

EXAMPLES: CHANDRA X-RAY OBSERVATORY, APOLLO (SATURN V) ROCKETS





HIGH EARTH ORBIT SATELLITE IMAGE OF M1

THE ORIGINAL HEO SATELLITE

TARGET SATELLITES

January, February and March: LEO Satellites: ISS, Space Shuttle, Weather, Remote Sensing and Debris;

April and May: MEO Satellites: Molniya, GPS and Debris;

June and July: GEO Satellites: Satellite TV, Weather and Debris;

August: HEO satellites: Space Probes and Debris; and any of the above; and

September through December: All of the Above: to reach the 1,957 satellite goal (and beyond?).

LEO ORBIT TRACKING

CASTOR Wide-Field is used;

The CCD (with 50mm lens attached) is pointed at the local zenith;

Observing begins (or ends) when Sun is 6.5 degrees below the local horizon;

5-second exposure images are taken every 5 seconds (5 second exposure, 5 second delay, 5 second exposure, etc.);

LEO satellites are detected as they “fly” through the FOV;

Every image is automatically stored, numbered and time-tagged;

Imaging generally lasts for two hours (approximately 600 images are collected);

Images are analyzed carefully for any satellite streaks after the tracking has concluded;

Images containing satellites are separated from the raw images to be analyzed (tracking data, photometric analysis, tumble period analysis, etc.).

N

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15944

2007 01 02 22 14 39.347 UTC - 5 sec

THE COSMOS 1674 SATELLITE

COSMOS 1674

ITNL: 1985-069A

NORAD: 15944

CASTOR: 0001

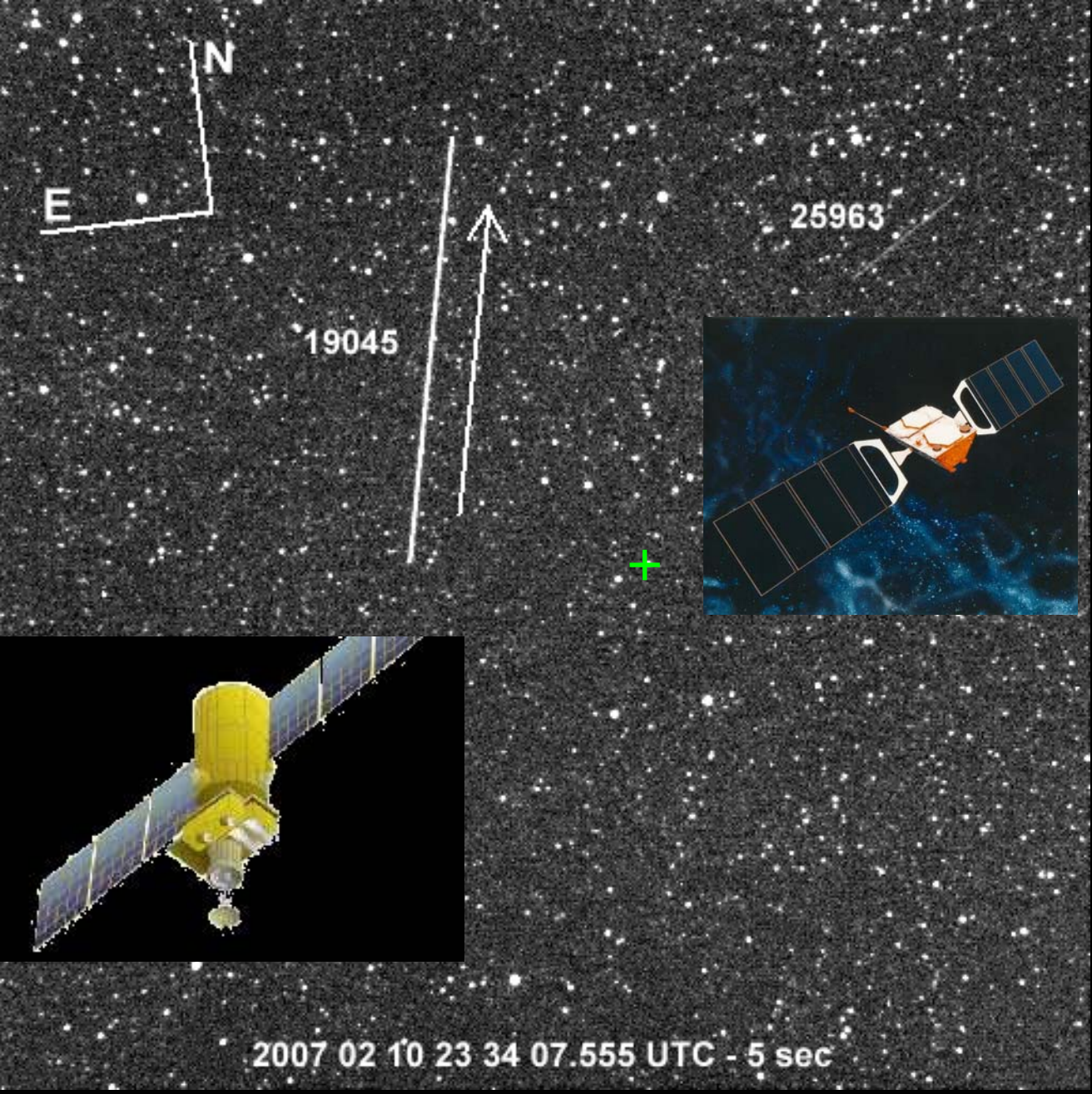
LAUNCH: AUGUST 8, 1985

END OF LIFE: NOVEMBER 1985

PART OF THE "ELINT" ELECTRONIC INTELLIGENCE NETWORK

CASTOR WIDE FIELD

FOV: 11.26 DEGREES
ANG. RES.: 1.32'/pix
R.A.: $00^h\ 02^m\ 24^s.7$
Dec.: $+44^O\ 18'\ 50"$



THE COSMOS 1939 SATELLITE

COSMOS 1939

(RESURS-01)

ITNL: 1988-032A

NORAD: 19045

CASTOR: 0231

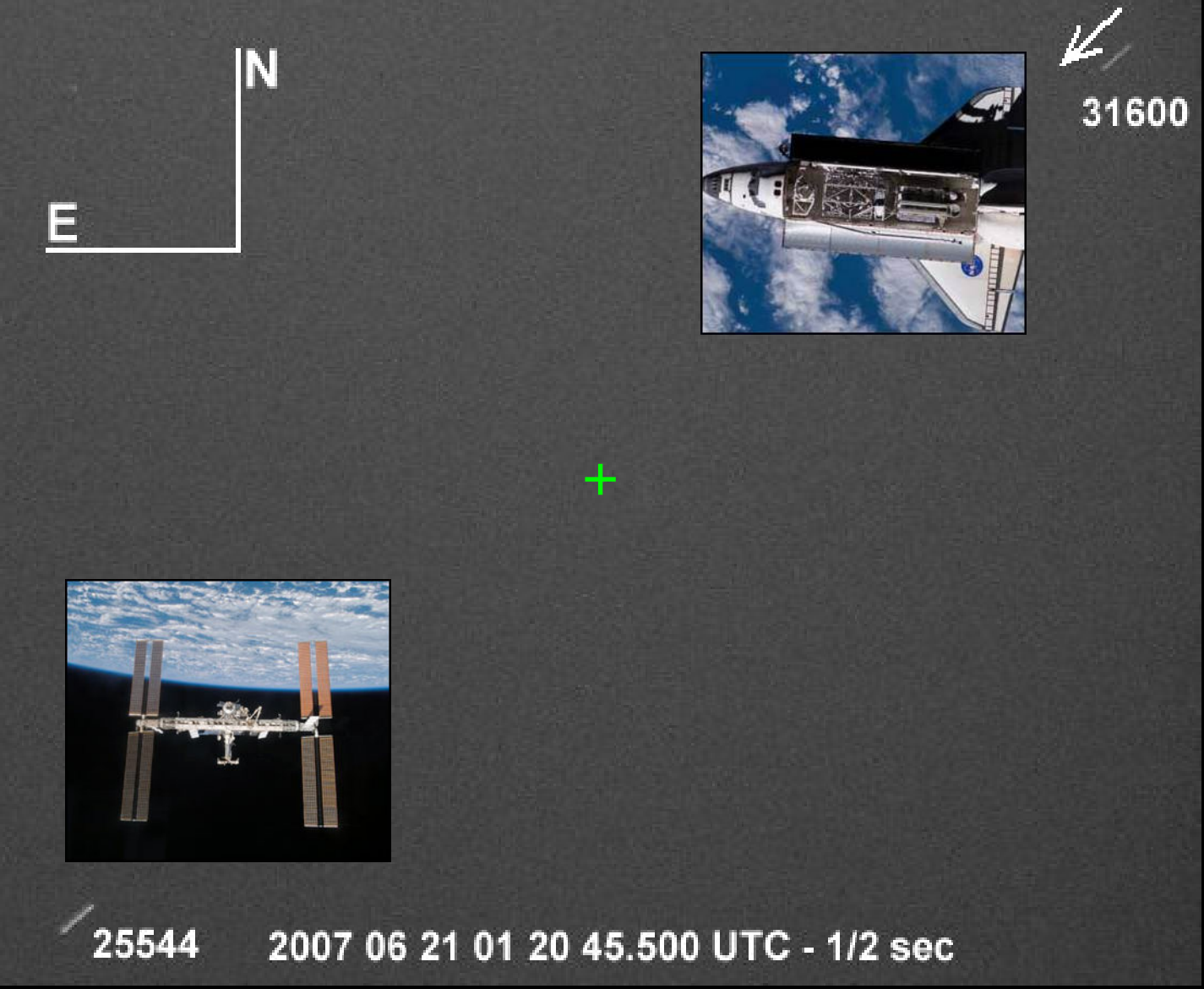
LAUNCH: APRIL 20, 1988

END OF LIFE: APRIL 1994

A REMOTE SENSING SATELLITE THAT MONITORED THE ENVIRONMENT

CASTOR WIDE FIELD

FOV: 11.26 DEGREES
ANG. RES.: 1.32'/pix
R.A.: $03^h\ 53^m\ 21^s.3$
Dec.: $+44^O\ 25'\ 49"$



SPACE SHUTTLE ATLANTIS AND THE INTERNATIONAL SPACE STATION (ISS)

SPACE SHUTTLE ATLANTIS

(STS-117)

ITNL: 2007-024A

NORAD: 31600

CASTOR: 1020

LAUNCH: JUNE 8, 2007

LANDING: JUNE 22, 2007

SPACE STATION MAINTENANCE AND CREW REPLACEMENT

NIKON COOLPIX 4500
VERY WIDE FIELD

ZENITH POINTING

MEO ORBIT TRACKING

CASTOR Junior and CASTOR Main are used;

Tracking begins (or ends) when the Sun is 12 degrees below the local horizon;

Exposure times are set according to each satellite's apparent angular velocity. Typical exposure times are between 5 and 30 seconds;

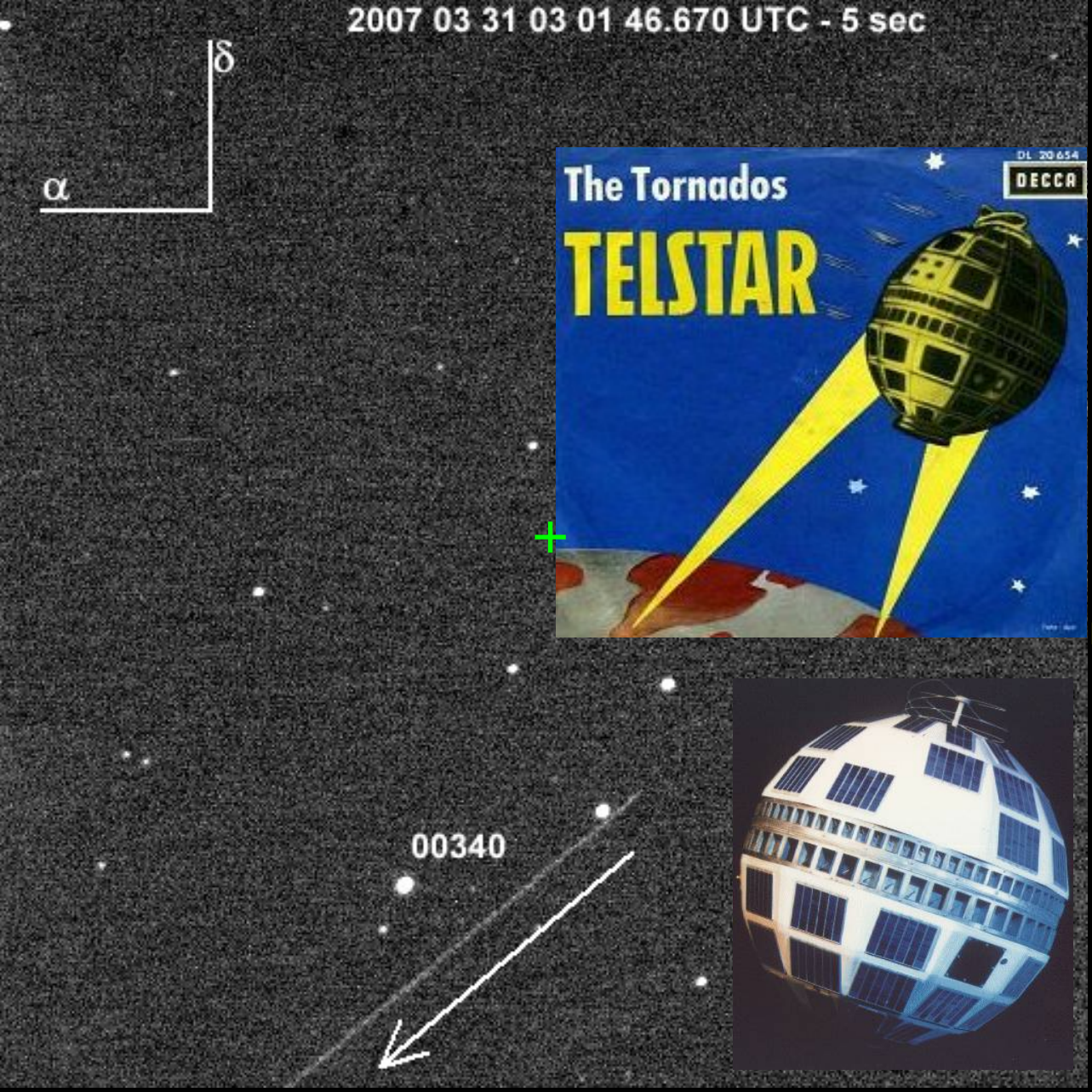
Every image is automatically stored, numbered and time-tagged;

The command to open the CCD's shutter is sent when the second's last digit displays a "0" or a "5". The time tag will be known to be either a "0" or a "5" during analysis;

Imaging can last for the entire night, depending on the weather conditions;

Images are analyzed carefully for any satellite streaks after the tracking has concluded; and

Images containing satellites are separated from the raw images to be analyzed (tracking data, photometric analysis, tumble period analysis, etc.).



TELSTAR 1

ITNL: 1962-029A

NORAD: 00340

CASTOR: 0466

LAUNCH: JULY 10, 1962

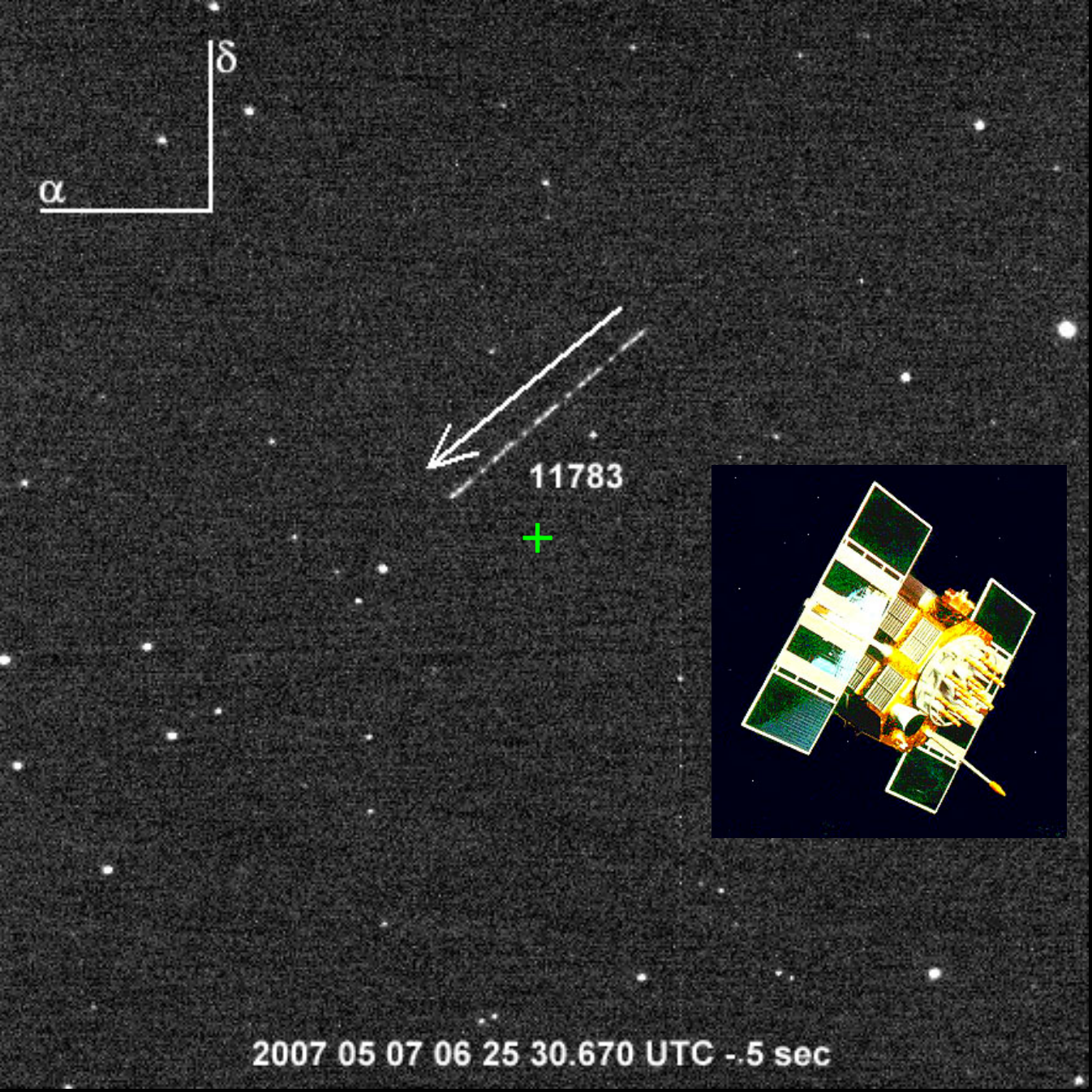
END OF LIFE: FEBRUARY 21, 1963

THE FIRST TRANSATLANTIC LIVE TELEVISION TRANSMISSION SATELLITE

CASTOR JUNIOR

FOV: 18.7 ARC-MINUTES
ANG. RES.: 2.20”/pix
R.A.: 14^{h} 22^{m} $01^{s}.16$
Dec.: $+20^{O}$ 20’ 56”.84

THE TELSTAR 1 SATELLITE



THE NAVSTAR 6 SATELLITE

NAVSTAR 6

(OPS 5118)

ITNL: 1980-032A

NORAD: 11783

CASTOR: 0769

LAUNCH: APRIL 26, 1980

END OF LIFE: MARCH 1991

ONE OF THE FIRST GENERATION GLOBAL POSITIONING SYSTEM (GPS) SATELLITES

CASTOR

FOV: 13.33 ARC-MINUTES
ANG. RES.: 1.562”/pix
R.A.: $17^h\ 09^m\ 25^s.06$
Dec.: $+57^o\ 33'\ 48''.47$

GEO ORBIT TRACKING

CASTOR Main is used;

Tracking begins (or ends) when the Sun is 12 degrees below the local horizon;

Typical exposure time is 10 seconds;

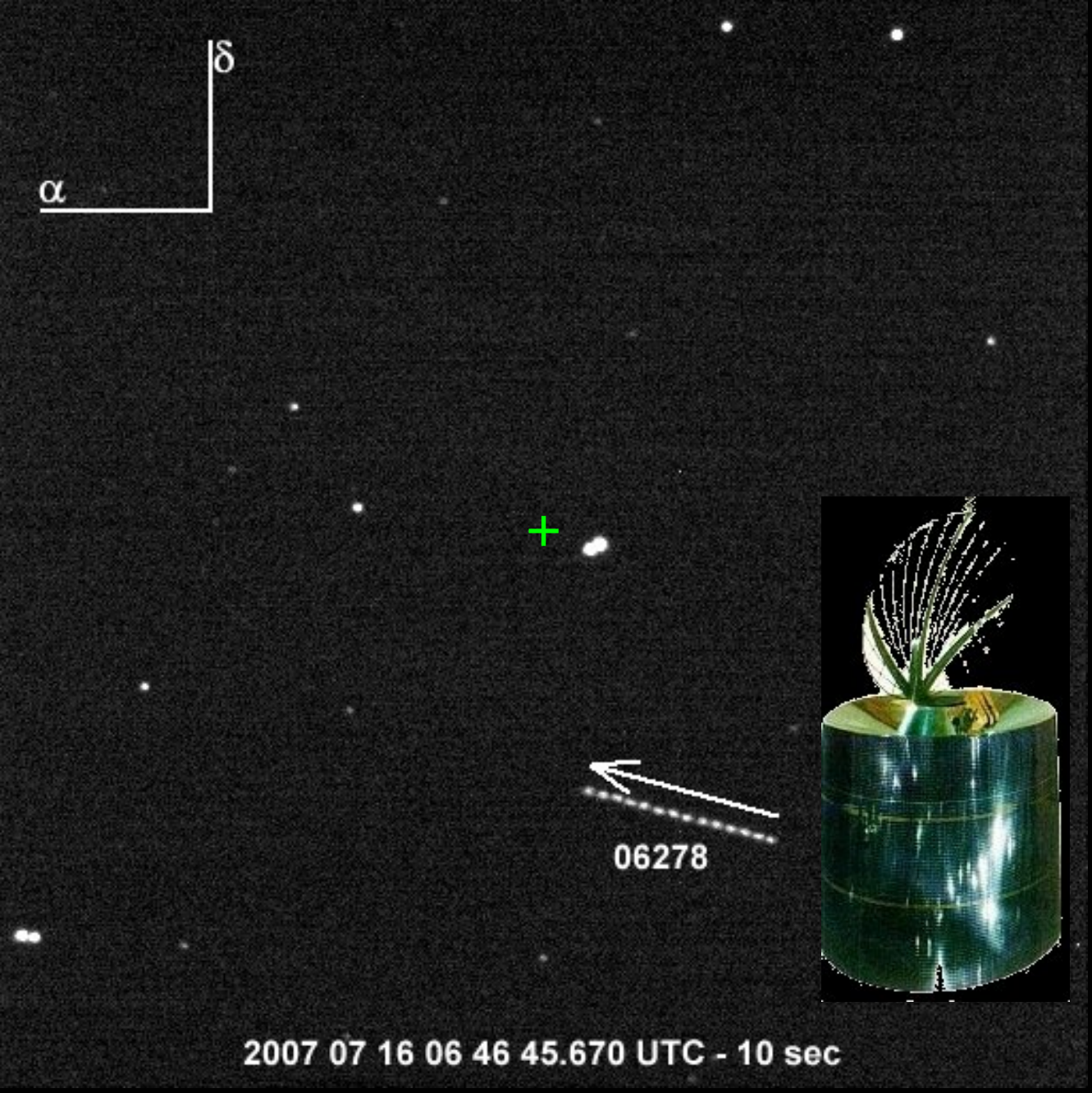
Every image is automatically stored, numbered and time-tagged.

The command to open the CCD's shutter is sent when the second's last digit displays a "0" or a "5". The time tag will be known to be either a "0" or a "5" during analysis;

Imaging can last for the entire night, depending on the weather conditions;

Images are analyzed carefully for any satellite streaks after the tracking has concluded.

Images containing satellites are separated from the raw images to be analyzed (tracking data, photometric analysis, tumble period analysis, etc.).



THE ANIK A1 SATELLITE

ANIK A1

(TELESAT 1)

ITNL: 1972-090A

NORAD: 06278

CASTOR: 1170

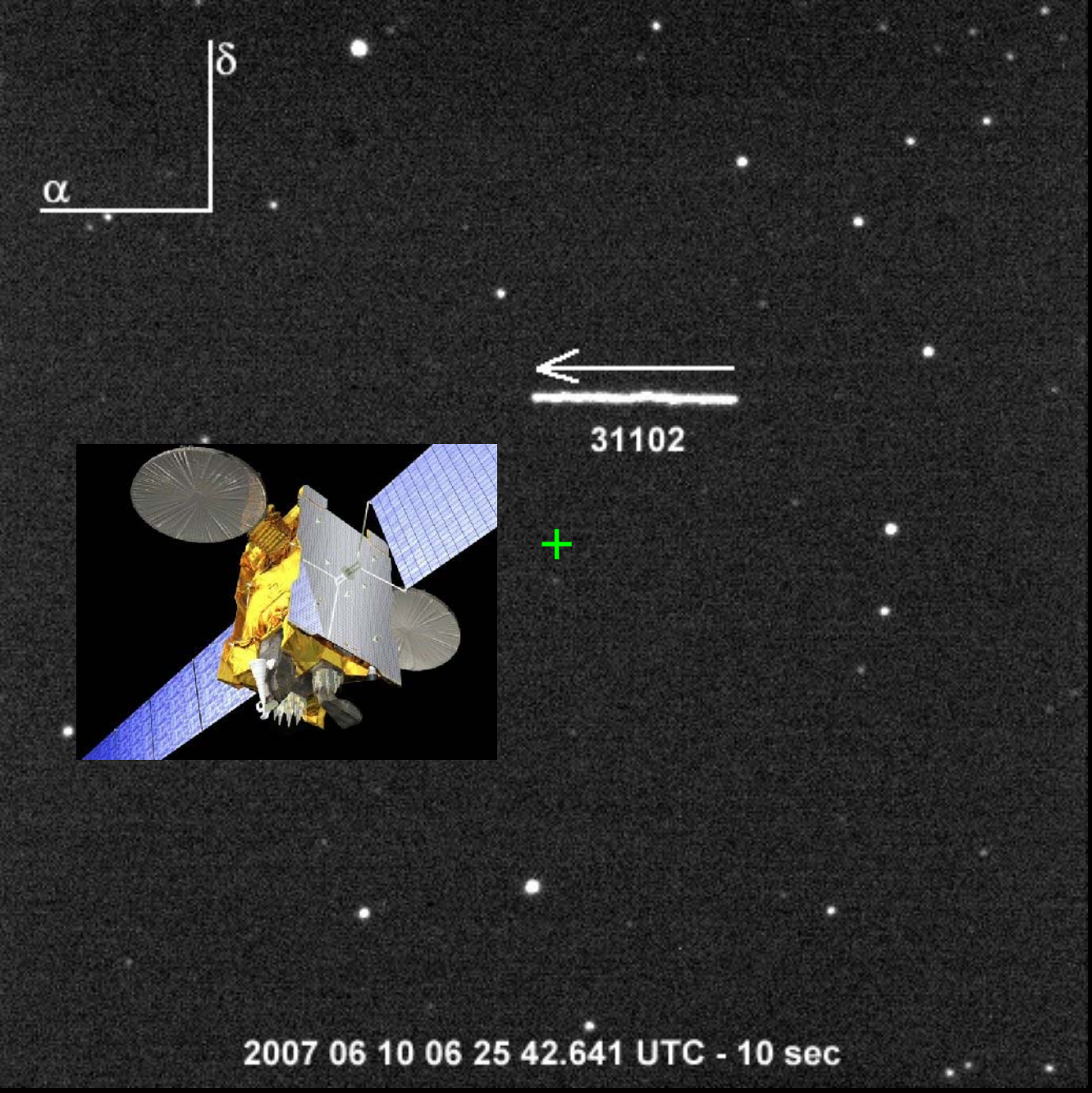
LAUNCH: NOVEMBER 10, 1972

END OF LIFE: JULY 15, 1982

THE FIRST DOMESTIC (NON-MILITARY) GEOSTATIONARY COMMUNICATIONS SATELLITE

CASTOR

FOV: 13.33 ARC-MINUTES
ANG. RES.: 1.562”/pix
R.A.: $22^h\ 54^m\ 06^s.17$
Dec.: $-11^o\ 51'\ 57''.04$



THE ANIK F3 SATELLITE

ANIK F3

ITNL: 2007-009A

NORAD: 31102

CASTOR: 0882

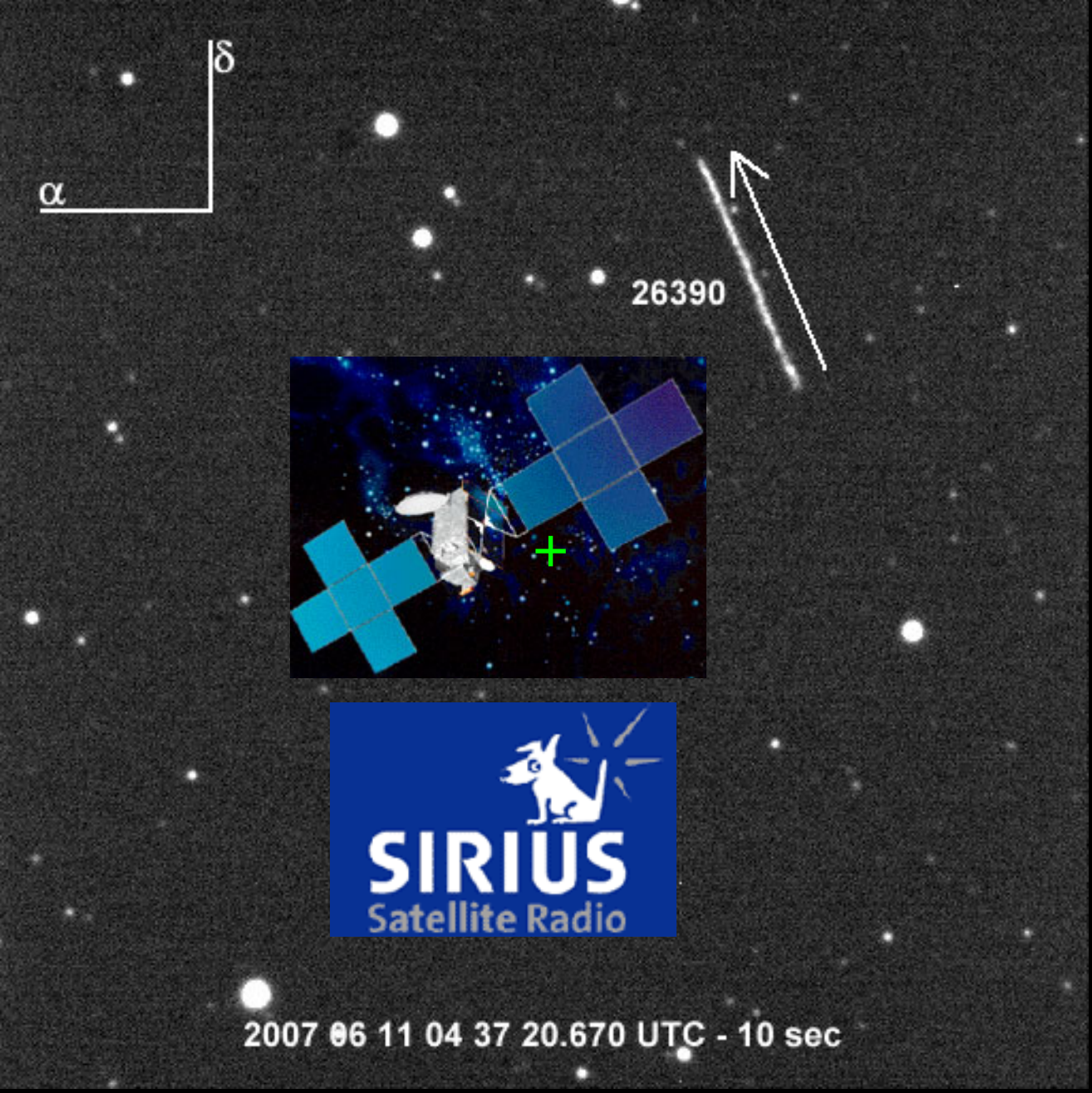
LAUNCH: APRIL 9, 2007

DESIGN LIFETIME: 15 YEARS

DOMESTIC GEOSTATIONARY COMMUNICATIONS, DIRECT-TO-HOME TV AND BROADBAND INTERNET SATELLITE

CASTOR

FOV: 13.33 ARC-MINUTES
ANG. RES.: 1.562”/pix
R.A.: $15^h\ 25^m\ 18^s.93$
Dec.: $-06^o\ 32’\ 53”.02$



SIRIUS 1

ITNL: 2000-035A

NORAD: 26390

CASTOR: 0915

LAUNCH: JUNE 30, 2000

DESIGN LIFETIME: 10-15 YEARS

NORTH AMERICAN GEOSYNCHRONOUS RADIO BROADCASTING SATELLITE

CASTOR

FOV: 13.33 ARC-MINUTES
ANG. RES.: 1.562”/pix
R.A.: $17^h\ 34^m\ 07^s.40$
Dec.: $-04^o\ 53'\ 52''.96$

THE SIRIUS 1 SATELLITE

HIGH EARTH ORBIT TRACKING

CASTOR Main is used;

Tracking starts (or ends) when the Sun is 12 degrees below the local horizon;

Typical exposure time is over 30 seconds. A HEO satellite has to travel sufficiently to reveal a streak on the image;

Every image is automatically stored, numbered and time-tagged;

The command to open the CCD's shutter is sent when the second's last digit displays a "0" or a "5". The time tag will be known to be either a "0" or a "5" during analysis;

Imaging is normally sporadic throughout the night, since there are so few HEO satellites;

Images are analyzed carefully for any satellite streaks after the tracking has concluded.

Images containing satellites are separated from the raw images to be analyzed (tracking data, photometric analysis, tumble period analysis, etc.).

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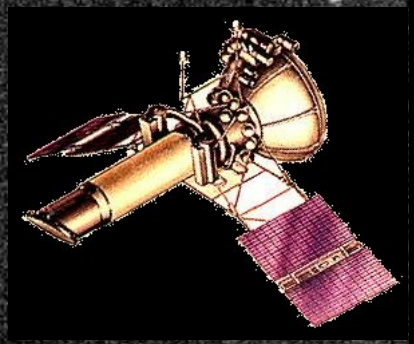
NGC 5387

13901

2MASX J13585043+0600032



2007 06 13 04 37 25.670 UTC - 30 sec

THE ASTRON SATELLITE

ASTRON

ITNL: 1983-020A

NORAD: 13901

CASTOR: 0978

LAUNCH: MARCH 23, 1983

END OF LIFE: JUNE 1989

UV AND X-RAY ASTROPHYSICS OBSERVATORY

CASTOR

FOV: 13.33 ARC-MINUTES
ANG. RES.: 1.562”/pix
R.A.: $13^h\ 58^m\ 32^s.82$
Dec.: $+06^O\ 03’\ 33.65”$

SATELLITES DETECTED BY *CASTOR*

JANUARY 1 TO OCTOBER 5, 2007

LEO Satellites:	669
MEO Satellites:	570
GEO Satellites:	449
HEO Satellites:	13

TOTAL: **1,701 Unique Satellites**

15.5% of total satellite population

SATELLITE DETECTION STATISTICS

JANUARY 1 TO OCTOBER 5, 2007

Nearest Satellite Detected: **ISS Debris (30426): 250km;**

Furthest Satellite Detected: **ASTRON Space Probe (13901): 196,000km;**

Oldest Satellite Detected: **Thor Ablestar Debris (00113) (Transit 4A Rocket): Launched June 29, 1961;**

Newest Satellite Detected: **STS-118: Space Shuttle Endeavor (32008): Launched August 8, 2007;**

Uncorrelated (Unknown) Satellites Detected: **39;**

Most Interesting Satellites Detected: **Telstar 1 (00340), ANIK A1 (06278), ASTRON (13901) and Fengyun 1C Debris (29933);**

Canadian Satellites Detected: ISIS 1, ANIK A1, ANIK C1, ANIK C2, ANIK D1, ANIK D2, ANIK E1, ANIK E2, ANIK F1, ANIK F1-R, ANIK F2, ANIK F3, NIMIQ 1, NIMIQ 2, MSAT M1, LACROSSE 2, LACROSSE 3, LACROSSE 5, and LACROSSE 5r.

CASTOR WEBSITE, ETC...

CASTOR website: www.castor2.ca

CASTOR e-mail: info@castor2.ca

CASTOR FTP: www.castor2.ca/15_Spy

CASTOR Presentation Slides: www.castor2.ca/11_Mike_Earl/05_Slides

About Mike Earl: www.castor2.ca/11_Mike_Earl