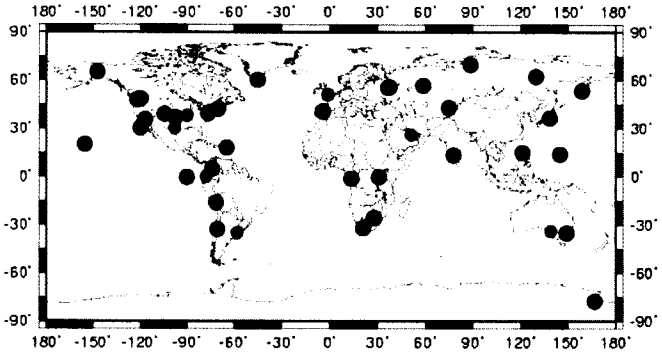
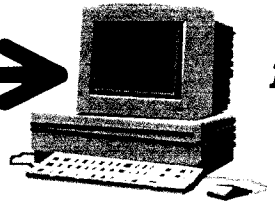
GDGPS System Overview

JPL processing center
running IGDG



Network receivers running IGDG

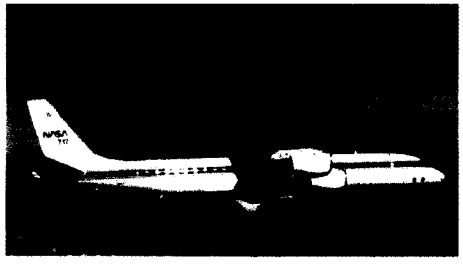
Internet



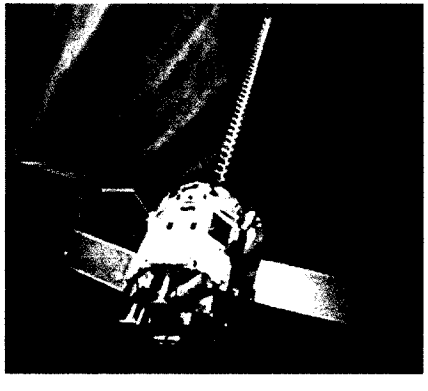
Broadcast

384 bps
Internet

Broadcast
256 bps



Remote user
Running IGDG



For more information see: http://gipsy.jpl.nasa.gov/igdg

GDGPS System Overview

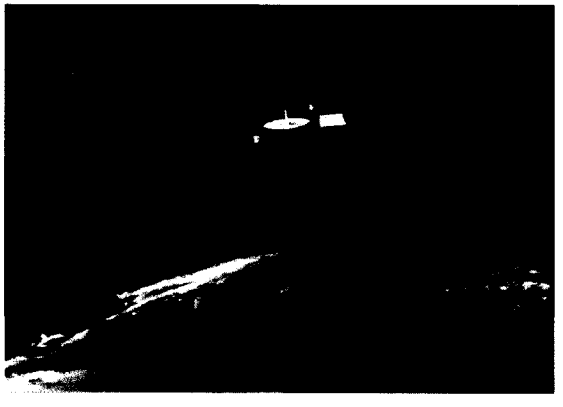
Revolutionary new capability:
decimeter real time positioning, anywhere, anytime

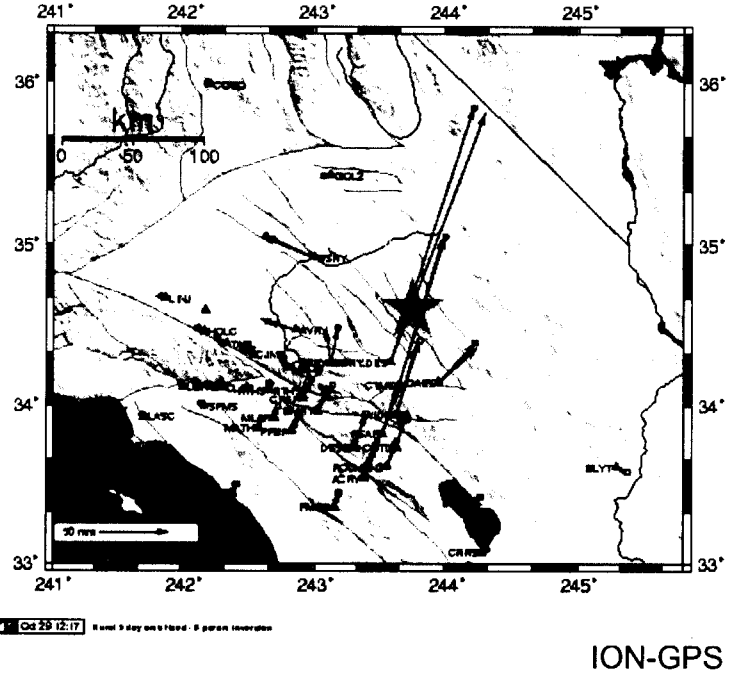
Capability		JPL s IGDG	Un-augmented GPS	Others (WADGPS services)
Coverage:	Global	Yes	Yes	No
	Seamless	Yes	Yes	No
	Usable in space	Yes	Yes	No
Accuracy:	Kinematic applications	0.1 m horizontal 0.2 m vertical	5 m	> 1 m
	Orbit determination	0.01 —0.30 m (goal)	1 m	N/A
Dissemination method		Internet/broadcast	Broadcast	Broadcast
Targeted users		Dual-frequency	Dual-frequency	Single-freq.

Value to NASA and Society

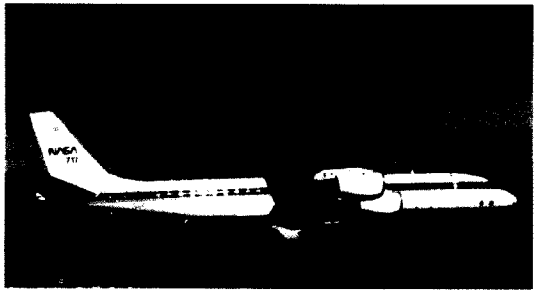
Autonomous operations in Earth orbit to reduce operational costs and communications bandwidth

Safe operations for NASA missions





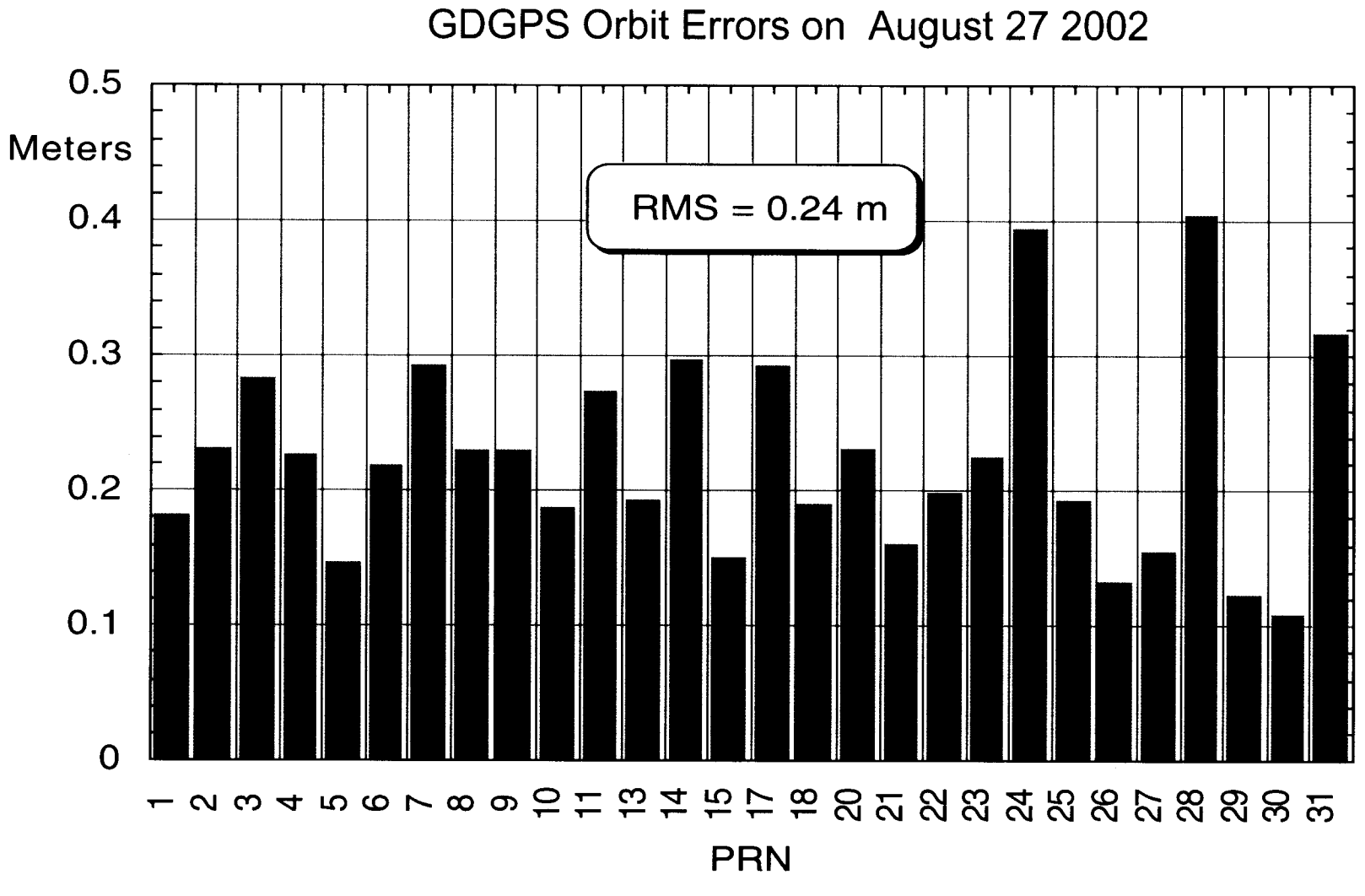
Aviation safety and efficiency



Timely monitoring and response to natural hazards

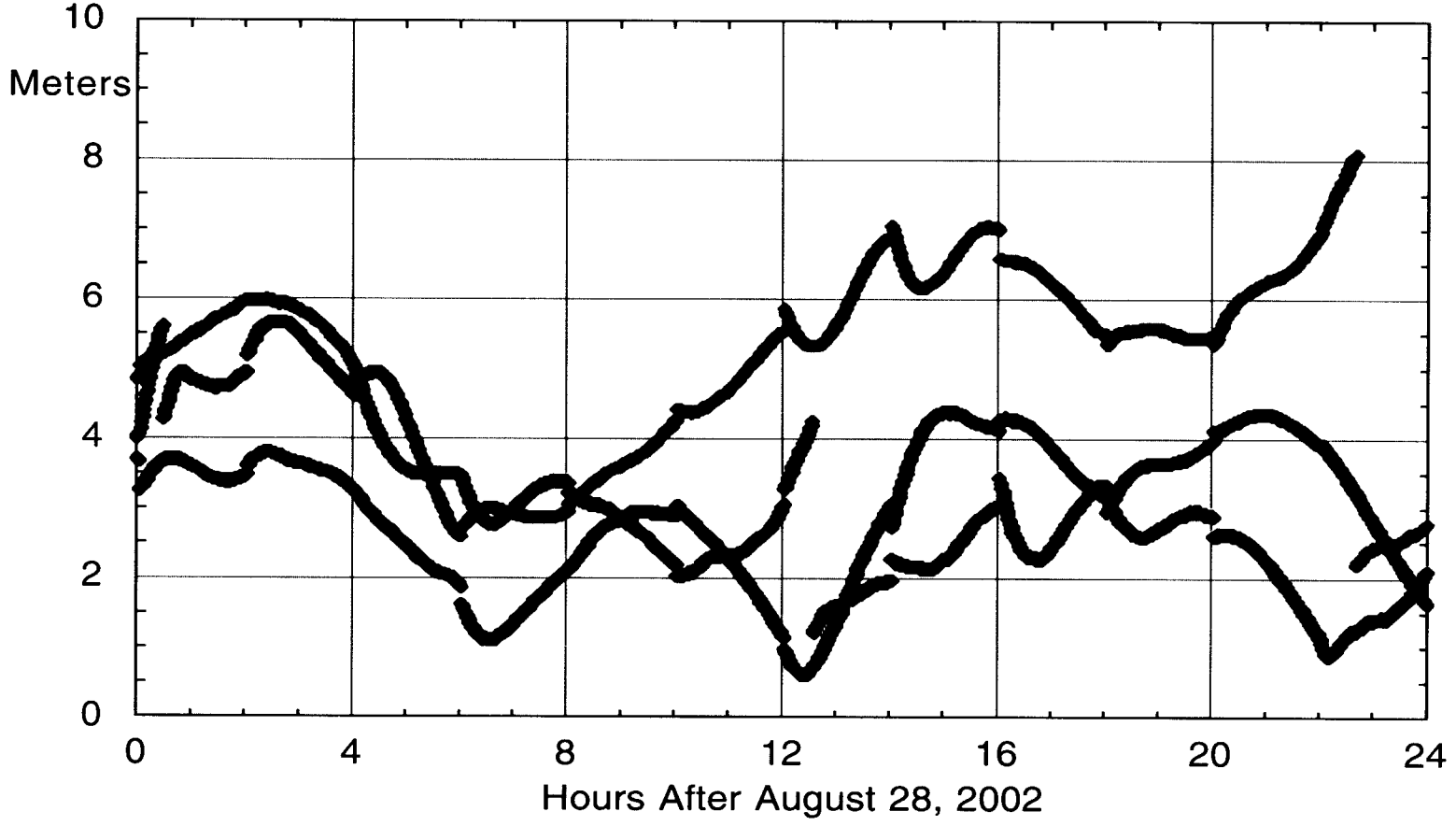
Many commercial applications

Measured Performance - GPS Orbits



Sample GPS Orbit Corrections

Magnitude of GDGPS Orbit Differential Corrections for SVNs 25 (black), 34 (green), and 35 (blue) on August 28 2002



Space-Borne Receiver Development

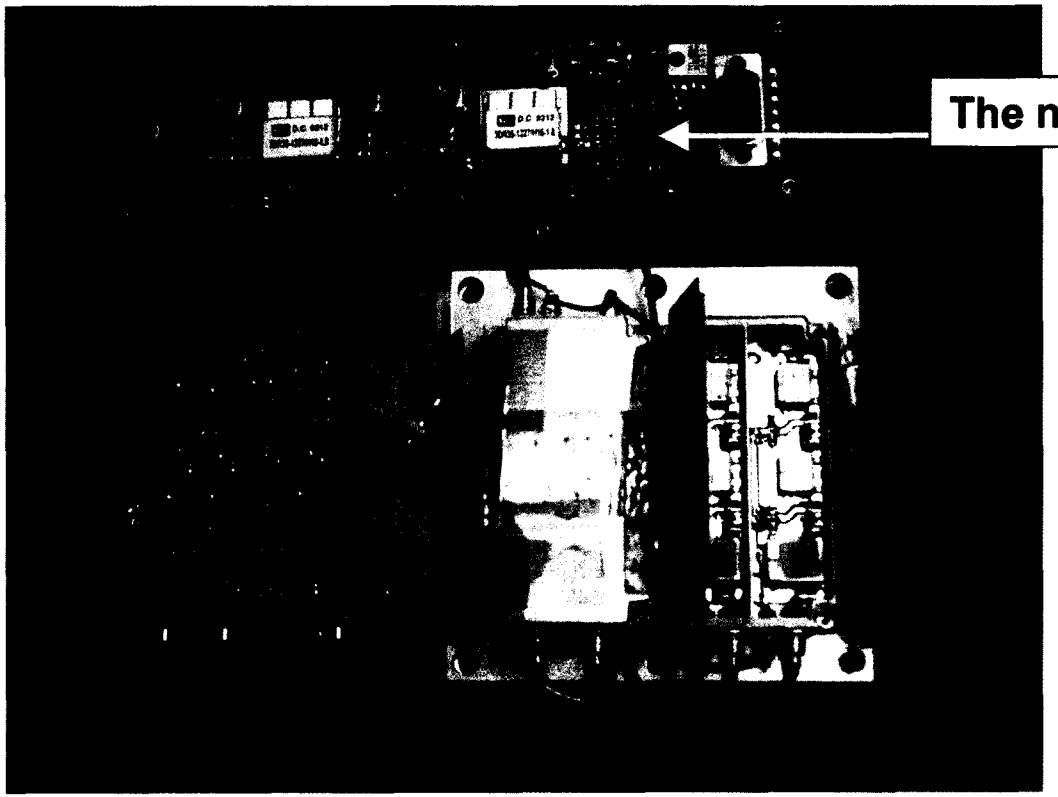
¥Universal front-end design may be applied to Inmarsat, GPS, Iridium, to enable all-in-one, compact differential GPS receiver (Next Generation GPS Receiver)

¥Design is modular to allow integration with non-JPL GPS receivers

¥Improvements in power, size, and repeatability compared to BlackJack front-end

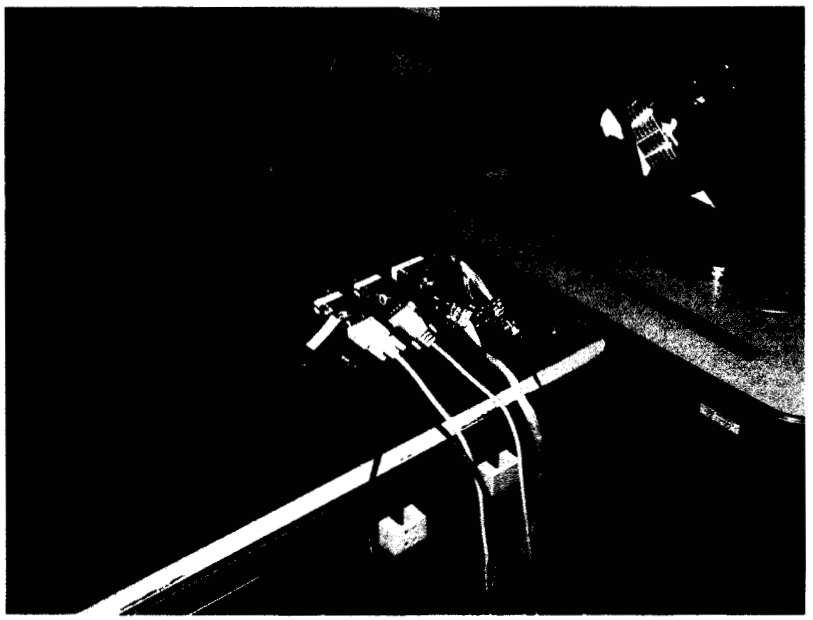
Prototype front-end board

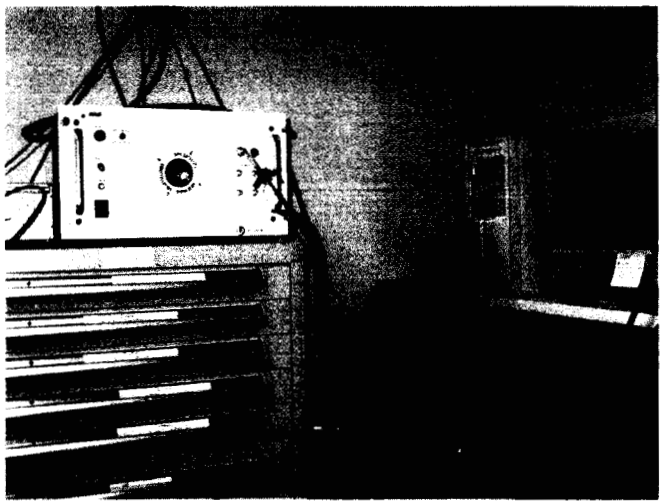
BlackJack front-end module

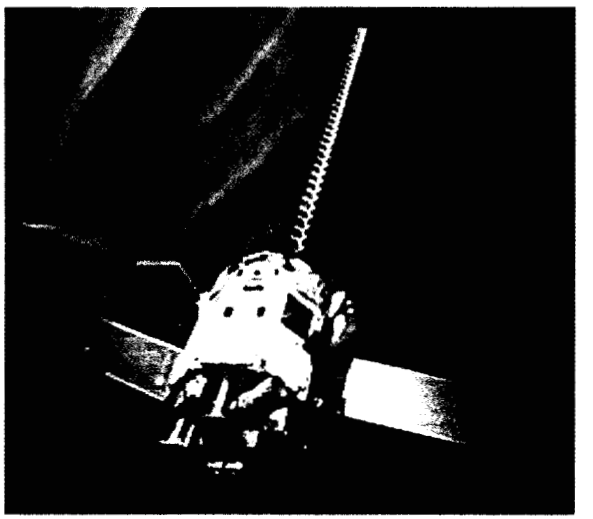


Flight Software: SAC-C Upload

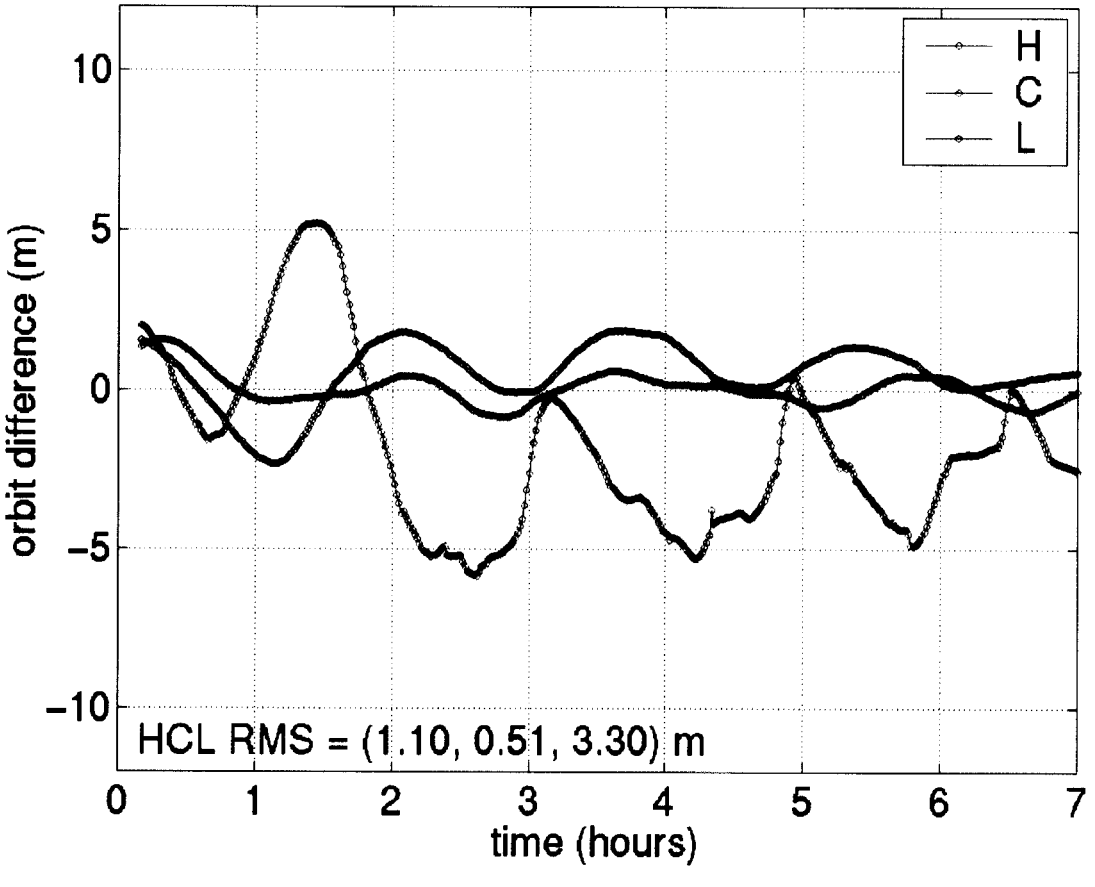
- RTG software ported to BlackJack flight GPS receiver (SAC-C EM)
  - Software had to be modified to be compatible with the Rogue OS
  - 500 KB compact code with 70x70 gravity field
- Upload of the code to SAC-C has begun in February







SAC-C On-orbit Results



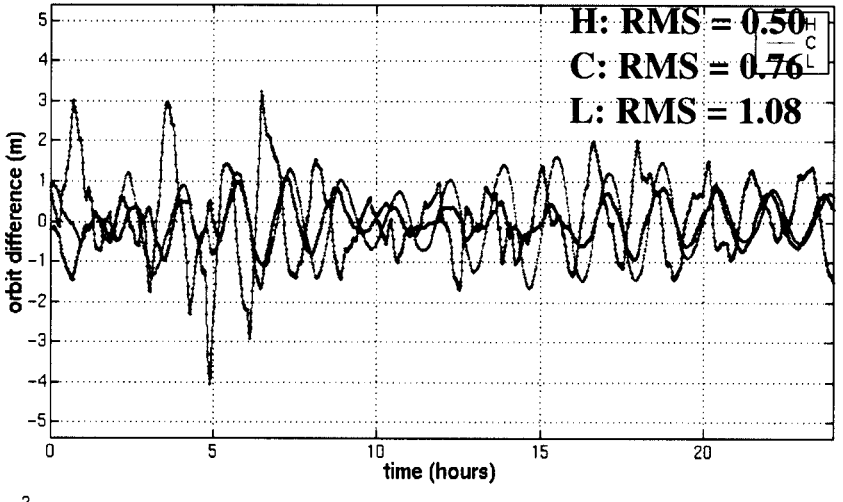
- Flight data processed onboard SAC-C with RTG using broadcast orbits
- Comparison to GIPSY post-processed solutions using quick-look products

Flight Software: Simulations

Assess end-to-end system performance of precise real time orbit determination
¥ Real simulations: real data from SAC-C, real GPS orbits, real-time filter
¥On-orbit performance expected to be better due to availability of high rate data

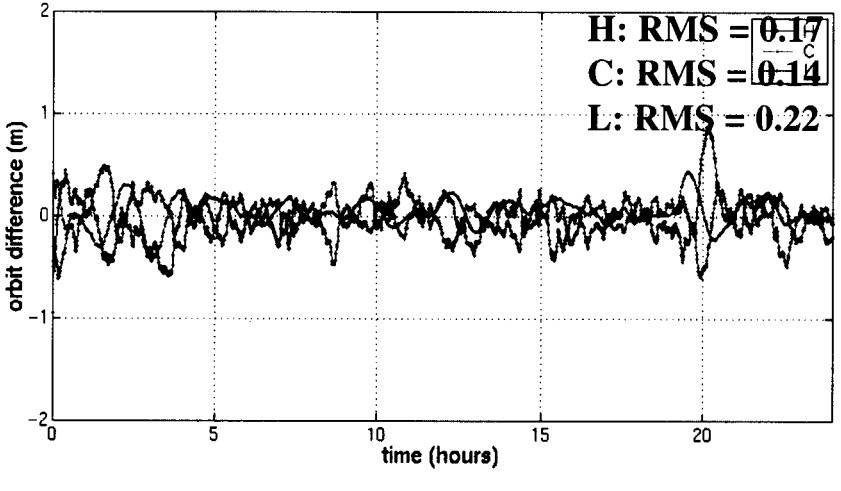
Altitude: 650 km

Simulations using GPS broadcast ephemerides



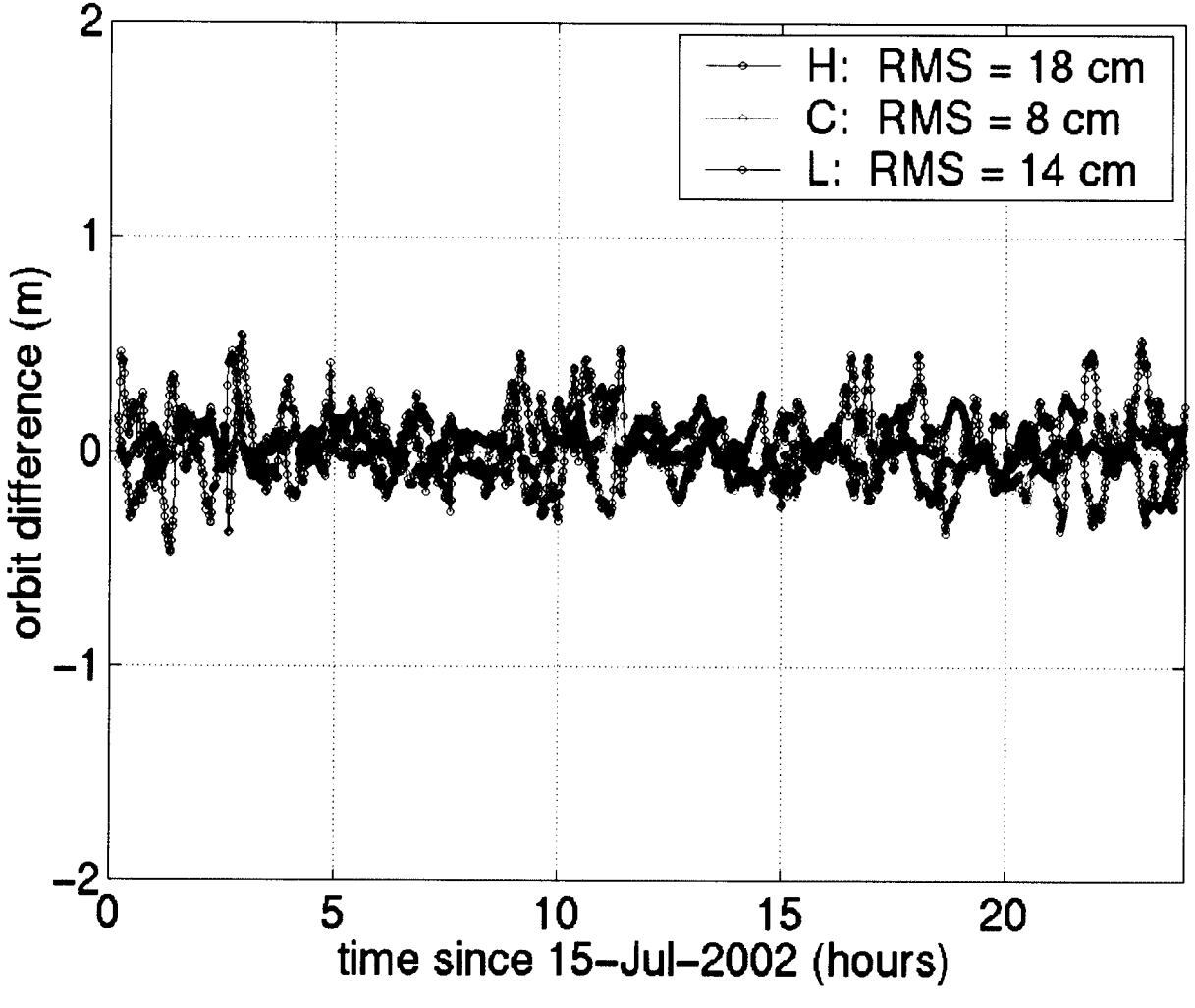
Expected performance onboard SAC-C

Simulation using GDGPS-corrected ephemerides



Expected performance for a future mission when the complete differential GPS receiver is deployed on a future SAC-C-like s/c

CHAMP Simulations



- Actual flight data from CHAMP
- Processed on the ground with RTG using GDGPS orbits
- Comparison to GIPSY post-processed solutions using Flinn orbits

Flight Software: Simulations

Real time orbit determination of Jason-1 (alt: 1300 km) satisfies Topex s orbit determination requirements (10 cm radial RMS)

¥Orbits are useful in tactical oceanography