NORAD SATELLITE TRACKING

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NORAD routinely tracks about 6000 orbiting objects. During the last 30 days of orbital time, prior to re-entry, special perturbations are used in the orbital update procedure. Besides routine orbit determination, NORAD does special tasks such as predicting satellite orbit conjunctions within 20 km, ephimerides of weather satellites, satellite decay predictions and other studies. Since their mission is operational, they do not store the data from their analyses. The ballistic coefficient (C_dA/m) is not known for most of the orbiting objects. (In principle it could be derived by numerical fitting, assuming that it is constant for a particular density model, but this has not been done.) If a ballistic coefficient were derived that was consistent with one density model, it might give erroneous results if used with a different density model. Given the ballistic coefficient, density values could, in principle, be obtained from their tracking data. The densities would represent an integrated mean over the orbital path near perigee. They would be model dependent and would not necessarily represent the "real" density.

NORAD's experience is that the Jacchia 1964/1965 model is as good as more recent models for all levels of solar activity, and runs significantly faster, since it is less complex. However, if solar flux (as indicated by F10.7) and geomagnetic activity (Ap) are known, then the density model needs improvement. Their experience is that the specified model altitude limitation of 1000 km does not appear to restrict the utility of the earlier models for predictions of highly eccentric satellite orbits.

It might be that orbital tracking data could be made available for scientific use, although the model dependence and lack of knowledge of the ballistic coefficient would make interpretation difficult.

In summary, the primary need is for reliable forecasts of F10.7 and Ap in the 1 to 4 week time scale. Forecasts over longer time spans would also be useful for special projects.

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SPECIFIC RECOMMENDATIONS AND SUGGESTIONS

TO IMPROVE THE EXISTING CAPABILITIES

- FORECASTING AND SPECIFICATION OF IONOSPHERIC PROPERTIES
- SOLAR PARTICLE RADIATION FORECASTING
- FORECASTING OF NEUTRAL DENSITY

NORAD/SPACECMD DAILY CATALOG MAINTENANCE

- MAINTAIN AND UPDATE ABOUT 6,000 OBJECTS
- MORE THAN 3/4 OF THE OBJECTS ARE UNDER SIGNIFICANT DRAG EFFECTS

CURRENT NORAD PROJECTS USING EMPIRICAL ATMOSPHERIC DENSITY MODEL

- o TIP (DECAY PREDICTION)
- o DNSP/NOAA (WEATHER SATELLITE EPHEMERIS)
- o COMBO (ORBIT CONJUNCTIONS)
- o SENSOR CALIBRATIONS
- o SDI
- o OTHERS

DEFICIENCIES

- ACCURACY
- EFFICIENCY

- $F_{10,7}$ AND Ap PREDICTIONS
- ALTITUDE LIMITATIONS