Operational Collision Risk Assessment: 
Are your satellites at risk?

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Agenda

- 1. Background information
- 2. Available solutions for risk control
- 3. User requirements for a customised solution with a reasonable cost
- 4. GMV’s solution: AutoMAT V2.0
- 5. New Skies Satellites’ experience
- 6. Conclusions
1. Background information

- **Objects:**
  - ~1000 tracked objects at GEO

- **Collision and close approach risks:**
  - estimated in 2001 that the probability of a collision at GEO in 13 years is 1%
  - as the number of satellites increases this may increase

- **Cost:**
  - Hardware
  - Lost revenue
  - Liability
2. Available solutions for collision risk assessment and control

- **Object orbital data:**
  - USSPACECOM (NORAD) catalog
  - Publicly available ‘Two Line Element’ (TLE) sets

- **Warning services provided by:**
  - MIT/Lincoln Labs
  - The Aerospace Corporation

- **Customised solution:**
  - based on use of TLE sets
3. User requirements for a customised solution with reasonable cost

- **Main goals:**
  - Low property cost,
  - Low operational cost,
  - High reliability

- **Automation**
  - Ingestion of operational orbital and manoeuvre information,
  - Download of TLEs,
  - Notification of results by e-mail
  - Rescheduling

- **Analysis at different levels**
4. GMV’s solution: AutoMAT V2.0 (I)

- **Origin**: AutoMAT V1.0
- **focusSuite®-based solution** for New Skies: Automated MA tool for GEO S/K simulations
- Automation capabilities provided by *Autofocus*
4. GMV’s solution: AutoMAT V2.0 (II)

- New computation module: CLOSEAP (mission-independent)
  - Retrieve TLEs and New Skies’ orbital (initial state vector) and manoeuvre data
  - Propgate as requested in time interval (SDP4 / focusGEO’s propagator), detecting close approaches
  - Generate plots and report and send notification to specified users
4. GMV’s solution: AutoMAT V2.0 (III)

- Algorithm description
  - Four levels of analysis:
    - 1) Box
    - 2) Absolute distance
    - 3) E-N-R distance
    - 4) Analysis mode
    - + Progressive mode: 1-> 4

- Efficient algorithm for close approach detection, optimised for GEO orbit, to minimise computation time by using
  - Adaptive time step
  - Quick exclusion of objects whose orbit cannot lead to a close approach

Ask for demo!!
5. New Skies Satellites’ experience with AutoMAT V2.0

- System installed at New Skies mid-2003
  - Determination of operating thresholds (accuracy of TLE data)
  - Collection of close approach statistics
- No objects found in New Skies satellite deadbands so far
  - my initial ‘guesstimate’ was two occurrences per satellite per year
6. Conclusions

- AutoMAT 2.0 fulfils all the New Skies requirements
- Flexibility built into the software
  - run initially with large deadbands and e-mailing results even if all OK
  - less monitoring necessary with confidence of miss distance criteria and understanding of TLE accuracy
- Exceptional value for money compared to other available solutions