Sensor Technology and Modeling
The Image Chain Approach to Fires Sensor Development

The Fires Group
June 2001
Technical Exchange Meeting
Scope of Task

- **Technical Scope:** Develop viable sensor model to allow selection and optimization of FIRES satellite detectors

- **Deliverable:** 1st draft report describing sensor modeling, results, and plans for future development

- **Period of Performance:** now until September 30

- **Team:**
  - John Schott
  - Bob Kremens
  - Graduate student gang: Stef, Dom, Andy
Key Milestones

- **Tasks defined** by May 30
- **Present at TEM** June 21
- **Project Review with other team members** by end of July
- **Write preliminary report** August 15 - September 30
Sensor modeling will be performed using the image chain methodology.

- Each optical/electronic component modeled independently.
- Output of one model is input to next component along chain.
- Iterative/parameterized approach to final design meeting the requirement criteria.
Analysis components are being developed and tested in a modular, iterative model.
More emphasis is now placed on uncooled detectors

- Initially, concentrate on uncooled detectors because their inherent simplicity

- Various configurations (staring array, push-broom, whisk-broom) pixilated bolometers being investigated from several vendors

- These detectors have some shortcomings. The study will determine the parameter range ($\text{NE}\Delta T$, resolution ($\text{GSD}$), temporal bandwidth) possible with these devices

- The extension to cooled detectors and other wavelengths is simple
Some parameters are now calculated using recognized modeling tools

- The ‘main’ program is written in a 4th GL language that is easy to read and verify. The calculations are not extensive.

- Detailed optical modeling performed using Sinclair Optics OSLO. This allows accurate calculation of resolution, especially for fast optics, off axis images

- MODTRAN used for atmospheric transmission modeling

- Research Systems, Inc. IDL used as a pre-processor to reduce some data for easier MATHCAD input.

- Multi-step process will be trimmed and consolidated as modules are verified
DIRSIG integration will require some rewriting and verification

- As components become ‘solid’ they are re-written in a low level language
- Test suites of data verified on low-level language modules (comparing with original 4th GL language versions)
- MODTRAN is already integrated into DIRSIG
- Optics parameterization (using ray-tracer or physical optics package) will be more difficult