

**Joint Venture Agreement between the USDA Forest Service Rocky Mountain
Research Station Firelab and Rochester Institute of Technology
May 2002**

A. Purpose

1. The purpose of this agreement is to establish a vehicle for collaboration and cooperative research between RMRS Firelab and the Rochester Institute of Technology Center for Imaging Science Digital Imaging and Remote Sensing Group (RIT-DIRS) in the areas of remote sensing of fires, development of novel fire measurement hardware, algorithm development for fire detection and monitoring, and data collection.

B. Statement of Mutual Interests and Benefits

2. RIT-DIRS has a fundamental mission to develop useful remote sensing methodologies and produce valid physical remote sensing models of wildland fires from a fundamental basis. To succeed in our mission we need to collaborate with experts in forestry and wildland fire phenomena to share resources, avoid duplication of effort and understand the problem fully. We also long-term interest in remote sensing hardware development, particularly multi-spectral cameras and LIDAR.
3. RIT-DIRS has expertise in modeling and physics-based remote sensing. We are not foresters, or experts in fire phenomena or the operational aspects of wildland fire fighting. Firelab and RIT-DIRS have overlapping interests and largely mutually exclusive knowledge. We expect that the Firelab/RIT-DIRS joint venture can be a powerful new force in the remote sensing of fires and fire phenomena.

C. Forest Service Goals:

4. The Forest Service (FS) shall share current data and expertise on wildland fire with RIT. The FS will provide access to data acquired in wildland settings and in the Firelab test chamber. The joint venture with RIT-DIRS will center primarily on fire effects on unburned fuels (fire effects) and thermal/radiant energy transport from the fire front. The FS will acquire a new understanding of the physical aspects of remote sensing from collaboration with RIT-DIRS.

D. Cooperator (RIT-DIRS) Goals:

1. Continuation of optical radiation studies of wildland fuel material flames, with particular attention to remote detection of heat pulse damage to trees adjacent to the fire. These studies may include (re) measurement of flame emissivity, emissivity and heat flux from fuels, modeling of the heat pulse using simple transport models, etc.
2. We will investigate and prepare a short 'straw man' report of the feasibility of using a low-resolution (VGA) video device in an airborne application. The device could be a narrowband filtered visible video camera (line emission from flame fronts), panchromatic video camera, or IR video camera (Inframetrics). The study will include investigation (and possible prototype) of a solid state roll/yaw sensor, position sensor using GPS, data acquisition system using digital videotape, and associated acquisition software. The goal of the study will be to produce a outline for a design of an inexpensive, unobtrusive video rate camera system for an airborne application.
3. Support field and laboratory data acquisition with RIT and FS instruments, including data analysis and recording. We hope to support burns in Baker City, Oregon, the Bitterroot Forest, and other locations as required. Burns later in the season will be supported by the RIT-DIRS autonomous environmental sensor (AES) for remote ground-based data acquisition.
4. We will perform motion analysis of high-speed movies (250 - 500 frames per second) taken in the burn chamber at Firelab to produce velocity profiles of active flames. Image analysis will take place manually or using RIT-written image analysis tools written the IDL programming environment.
5. As RIT-DIRS is a student training organization as well as a research organization, undergraduate and graduate students will be involved as much as is feasible during this first joint venture. Students in our laboratory will be working as a team with staff from RIT-DIRS and the FS.