Technical feasibilities of the Novalis image-guided localization system, composed of dual-infrared cameras, a video camera, and a dual-detector/tube KV x-ray imaging system, are investigated. The infrared cameras and video camera are used to guide and monitor patient setup and movement. Dual-KV x-ray imagers are used to identify deviations between planned and actual target locations based on either anatomical or implanted markers used for image fusion. Patient shift and rotational information could be identified using a rigid body 3-D to 2-D image fusion technique in which DRRs are generated iteratively with different angulations to simulate potential patient deviations in all directions. Mechanically, each x-ray tube is capable of providing 55% full views of images, 28% partial images, and 17% blocked images around 360 gantry degrees. Both full-view x-ray images are available only at very few gantry orientations, such as 0, 90 and 270 gantry angles. Systematic measurement of exposure at the isocenter indicated that the highest and average typical clinical imaging doses are less than 0.10 cGy and 0.05 cGy per image, respectively. The accuracy of the imaging device for target localization evaluated with rigid-body phantom studies indicated an accuracy of 1 mm shift and 1 degree rotation. Image fusion based implanted markers are more stable than those based on anatomic markers. The system, along with a dedicated immobilization device, could be used for high accuracy target localization, treatment monitoring, and verification during the process of extracranial radiosurgery. Verifying image fusing results and motion organs require special cautions.