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# Creation of NAIF SPICE kernels to support the restored Mariner Mars 1969 images

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The NAIF SPICE system (Acton, 2017) did not exist when Mariners 6 and7 flew by Mars in 1969 and took hundreds of far and near encounter images. These images have been restored to Planetary Data System 4 standards. Old documents were discovered that had printed data that gave the image time tags and spacecraft positions relative to Mars that were used to create spacecraft trajectory files (.bsp kernels). Using these .bsp kernels together with the restored images, planetary ephemerides, star catalog and the global MOLA Mars Digital Terrain Model (Neumann, et al., 2004) , the spacecraft frames (.tf kernels), spacecraft attitude (.bc kernels), camera pointing (.bc kernels), camera models (.ti kernels) and spacecraft clock (.tsc kernels) were reconstructed. Ancillary tables containing a searchable image catalog that allows one to determine which images contain any of the 40 Mars quadrants and landers / rovers, a star catalog and the geometric distortion parameter values of each image were also produced to complete the Mariner Mars 1969 Image / SPICE Kernel Bundle Archive. Details of the unique approaches used to restore the images and create the associated SPICE kernels and catalogs will be presented, making the nearly 50 year-old Mariner 69 images as useable today as the current Mars Express, Mars Odyssey, Mars Reconnaissance Orbiter and Trace Gas Orbiter data.