Saturn Coordinates Systems

I would like to propose a naming convention for the Saturn coordinate systems we are going to use. These systems have been illustrated on the team website by Joyce Wolf. To help us remember these names they are derived from their Earth equivalents. For the earth we use the prefix "geo" in naming coordinate systems and the word "centric" to denote the coordinate system is centered on the Earth. The corresponding (Greek) prefix for Saturn is 'krono'.

1. The first system that Joyce illustrates is sun oriented with its polar axis along the rotation axis. I propose we call this the Kronocentric Solar Magnetospheric system (KSM) in analogy with the terrestrial GSM. The purpose of GSM is to order magnetopause and tail observations. At Saturn the field is closely aligned with the rotation axis, so this system serves the same purpose at Saturn. I recommend labeling the axes x,y,z as we do at Earth.

[The reason for picking any set of triplet of letter for a coordinate system is a) to remind you which order the RIGHT-HANDED system is in, b) to remind you where each axis points. I would choose a different set of letters if we were beginning from scratch but x,y,z have been historically used at Earth and we have coped.]

2. The second system Joyce illustrates is a local coordinate system whose axes are determined by where the spacecraft is. The prime directions are radially outward, in the direction of the cross product of the rotation axis and the outward radial vector and the direction of the cross product of the outward radial vector and the second vector above (east). At Earth these directions are radial, east and north. Thus I propose we call this system Kronocentric Radial, East and North (KREN). Classic terrestrial geomagneticians will realize that on Earth we call the system xyz (again) with x north, y east and z down. Z was chosen to be down because a plumb bob was used to define the vertical direction when setting up the magnetometers but it has confused generations of students since. We all expect vectors to radiate from the center of the coordinate system. I propose we label the axes r,e,n. [Again this goes against my rule of choosing letters for which the natural order is not obvious but we have used this system extensively enough on Earth that maybe we can remember]

3. The third system Joyce illustrates is the equivalent of the terrestrial geographic system. Here the first axis is in the prime meridian, the second axis is in quadrature with it and also in the rotational equator in the direction of the rotation axis crossed into the equatorial prime meridian vector. The third direction is along the rotation axis. I propose we refer to this system as the Kronographic system and label the axes p,q,z [prime meridian, quadrature and z - the same as z in system KSM]. Note that we must use this system very carefully and perhaps infrequently. We do not know the rotation rate of Saturn very well. We will be at Saturn for many years and it has been many more years since Pioneer and Voyager were there. We have no idea where the zero degree longitude
of Saturn is now that was defined back then. Until we determine the rotation rate of Saturn precisely we will have difficulty comparing with Pioneer and Voyager data and comparing our measurements of the internal field over the course of the mission. Thus when using this coordinate system it would be wise always to define its epoch and rotation rate or a reference to the same.

Chris.