Navigation and Ancillary Information Facility
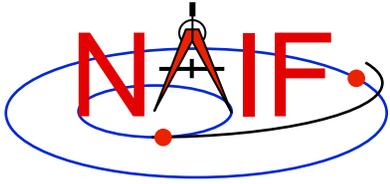
Motivation for Developing SPICE

April 2016
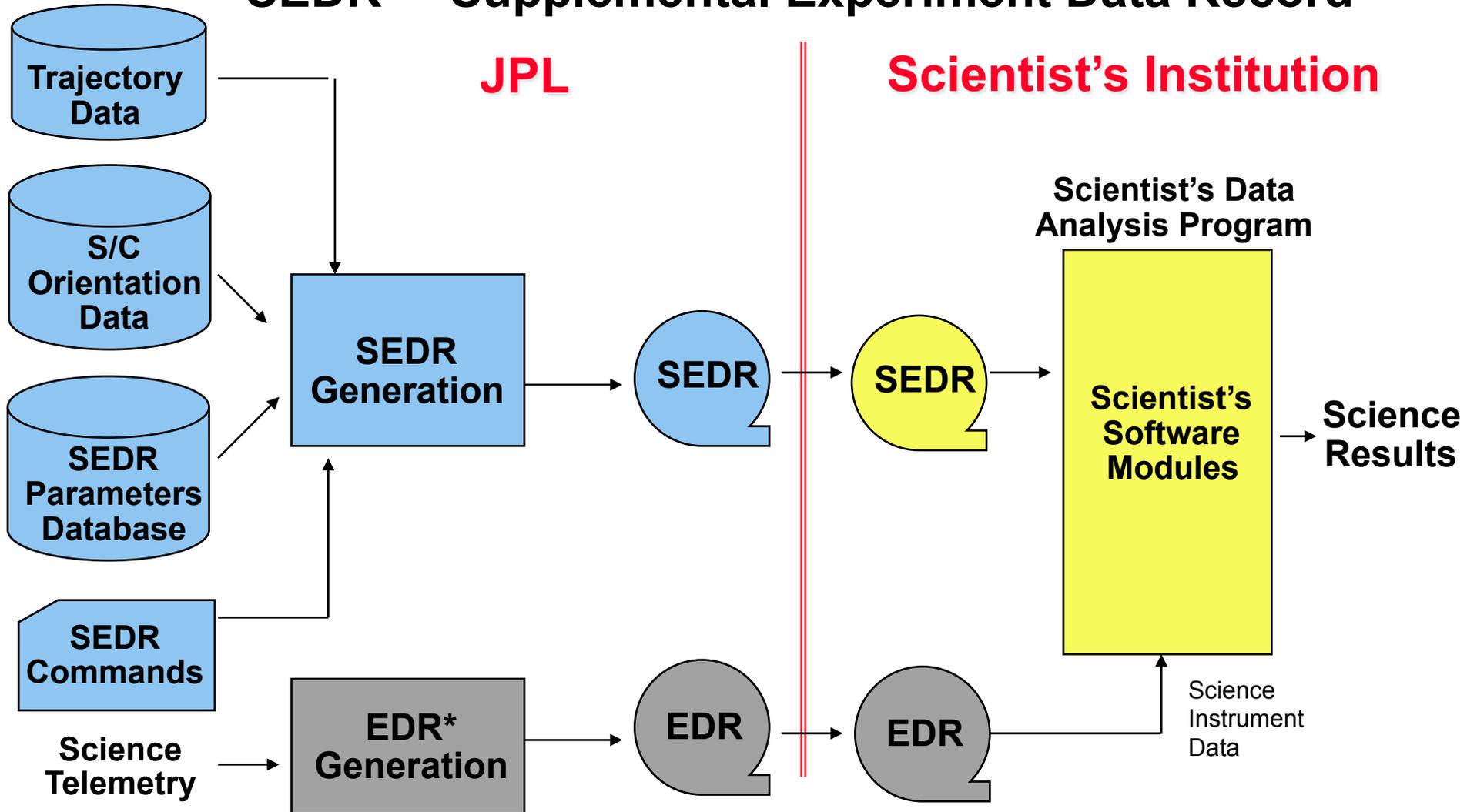
Navigation and Ancillary Information Facility

• **Scientists said they would like to:**

- **use common tools and methods throughout a project's lifecycle, and for all projects (national and international)**

- **understand the calculations and transformations used to produce observation geometry data**

- **be able to produce custom geometry calculations themselves, whenever and however they want**

- **have the ability to revise the fundamental data and software tools used to produce their own observation geometry data**
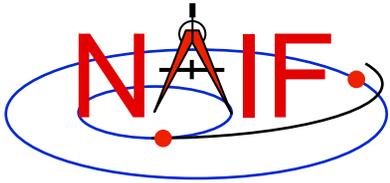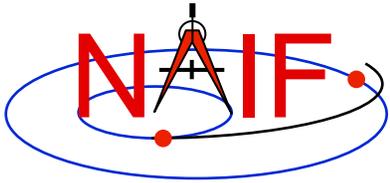
What Existed Prior to SPICE ?

Navigation and Ancillary Information Facility

## "SEDR" - Supplemental Experiment Data Record

JPL | **Scientist's Institution**

Trajectory Data

S/C Orientation Data

SEDR Parameters Database

SEDR Commands

Science Telemetry

SEDR Generation → SEDR → SEDR → Scientist's Software Modules → Science Results

Scientist's Data Analysis Program

EDR* Generation → EDR → EDR → Science Instrument Data

* EDR = Experiment Data Record = "raw" science instrument data
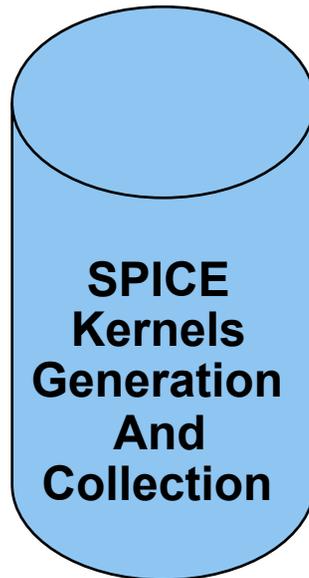
SEDR System Characteristics

- **The SEDR Generation program was built and operated at JPL**
  - Scientist's requirements on SEDR had to be provided long before launch
    » Late or post-launch updates were hard/expensive to accommodate
      - Difficult to change WHAT gets computed
      - Difficult to change HOW items are computed (algorithms, parameters)
      - Difficult to change the TIMEs at which items get computed
  - Generally only one SEDR file would be produced for each period of time
    » Result: the scientist can't get better ancillary data if/when better inputs (e.g. spacecraft trajectory or orientation) are determined
  - SEDR generation was done "in the blind"
    » Operators were not familiar with processes used to make the inputs
    » Operators were not familiar with scientist's processing schemes
    » Result: SEDR may not fully meet science team's expectations
  - The SEDR system was not exportable to other institutions
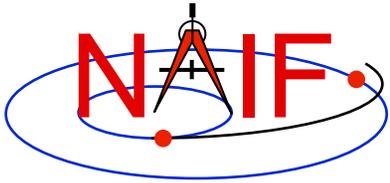
The SPICE Idea

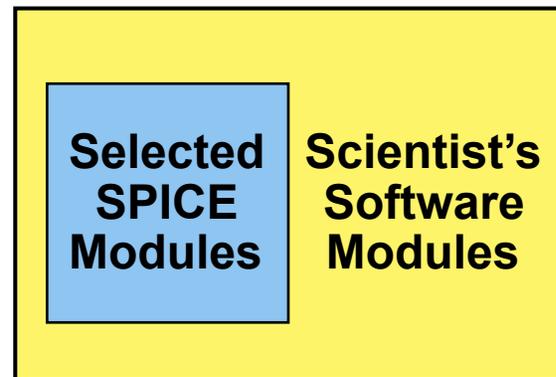**Any Mission Operations Center**

Scientist's Institution

Scientist's Data Analysis Program

SPICE Kernels Generation And Collection

Selected SPICE Modules

Scientist's Software Modules

Wonderful Science Results

Science Telemetry
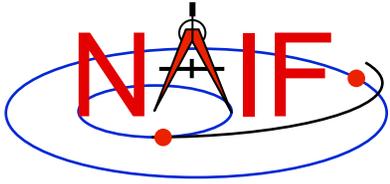
SPICE Benefits vs. SEDR

- ## The customer has great flexibility in deciding:
  - what observation geometry parameters are computed
  - at what times or at what frequency these parameters are computed
  - for what time span these parameters are computed
  - electing if/when to re-do parameter computations using new (better) or otherwise different data as inputs

- ## The customer also has:
  - common tools and methods that can be reused on many tasks
  - good visibility into algorithms and data used in geometry calculations

- ## The flight project operations center can:
  - concentrate on producing better ancillary data, rather than on producing lots of SEDRs and frequently updating the SEDR software

- ## The SPICE process may be replicated anywhere
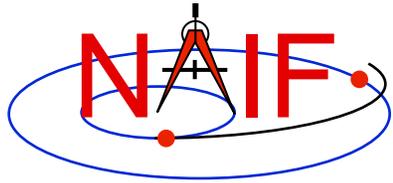
The Down Side:
SPICE Detriments vs. SEDR

- End users ("consumers") must do some non-trivial programming to read SPICE data and compute whatever is needed

- If the mission operations center is other than JPL, the appropriate project people need to learn how to produce SPICE data

- In some areas of SPICE the offering of choices to allow correct handling of different situations may present complexity that is unwarranted for "simple" problems