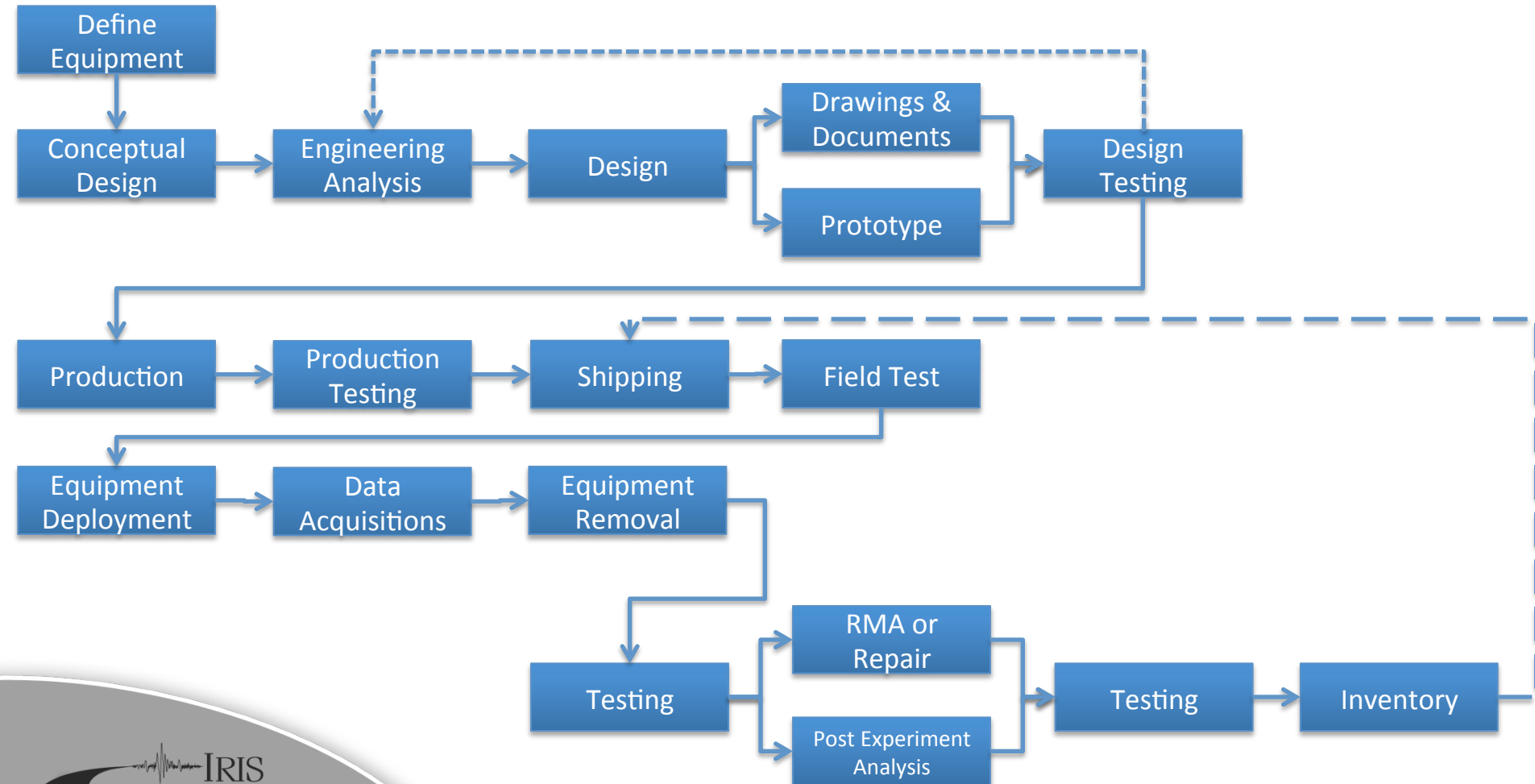


PASSCAL Engineering Methodology

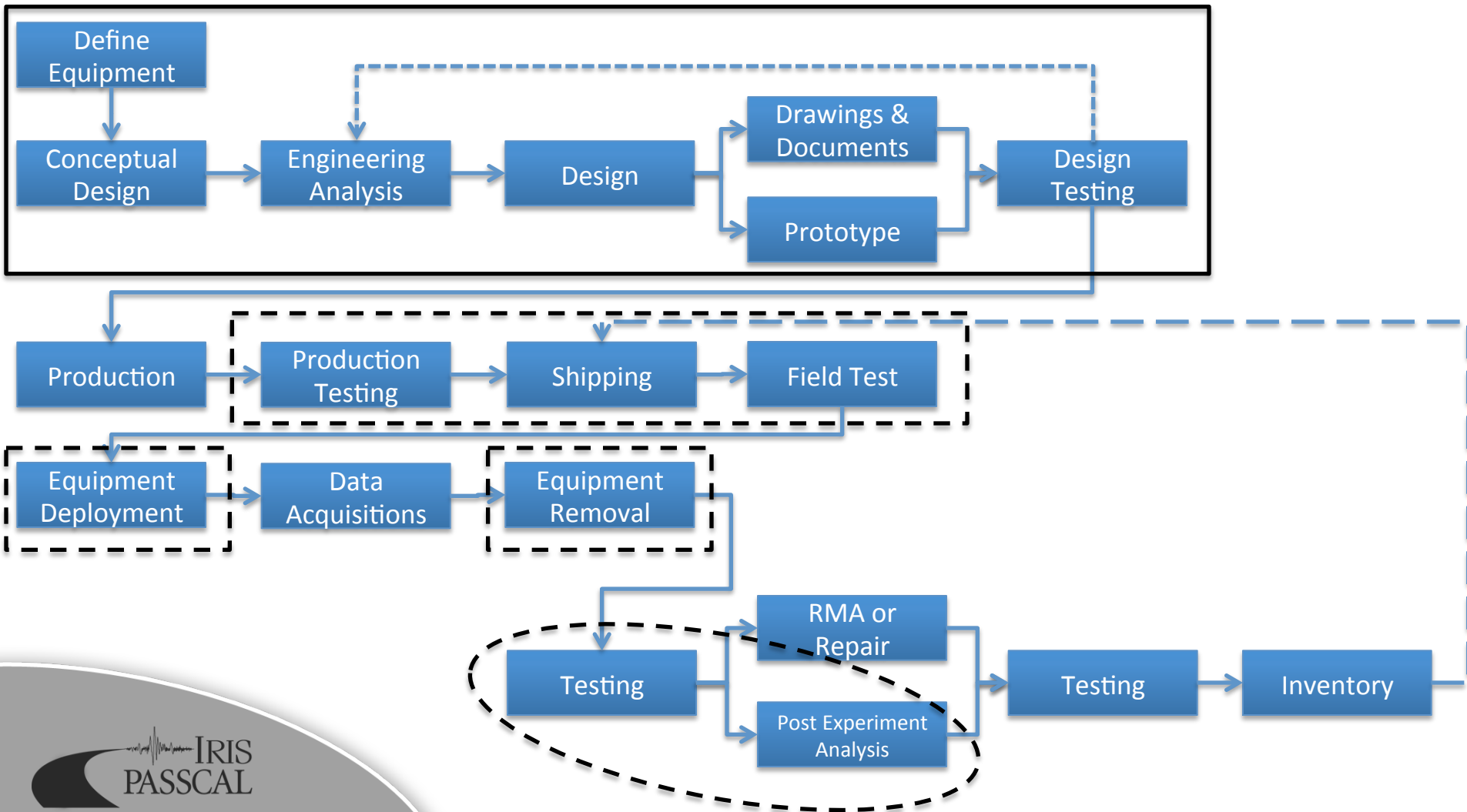
Paul Carpenter

4/12/2016

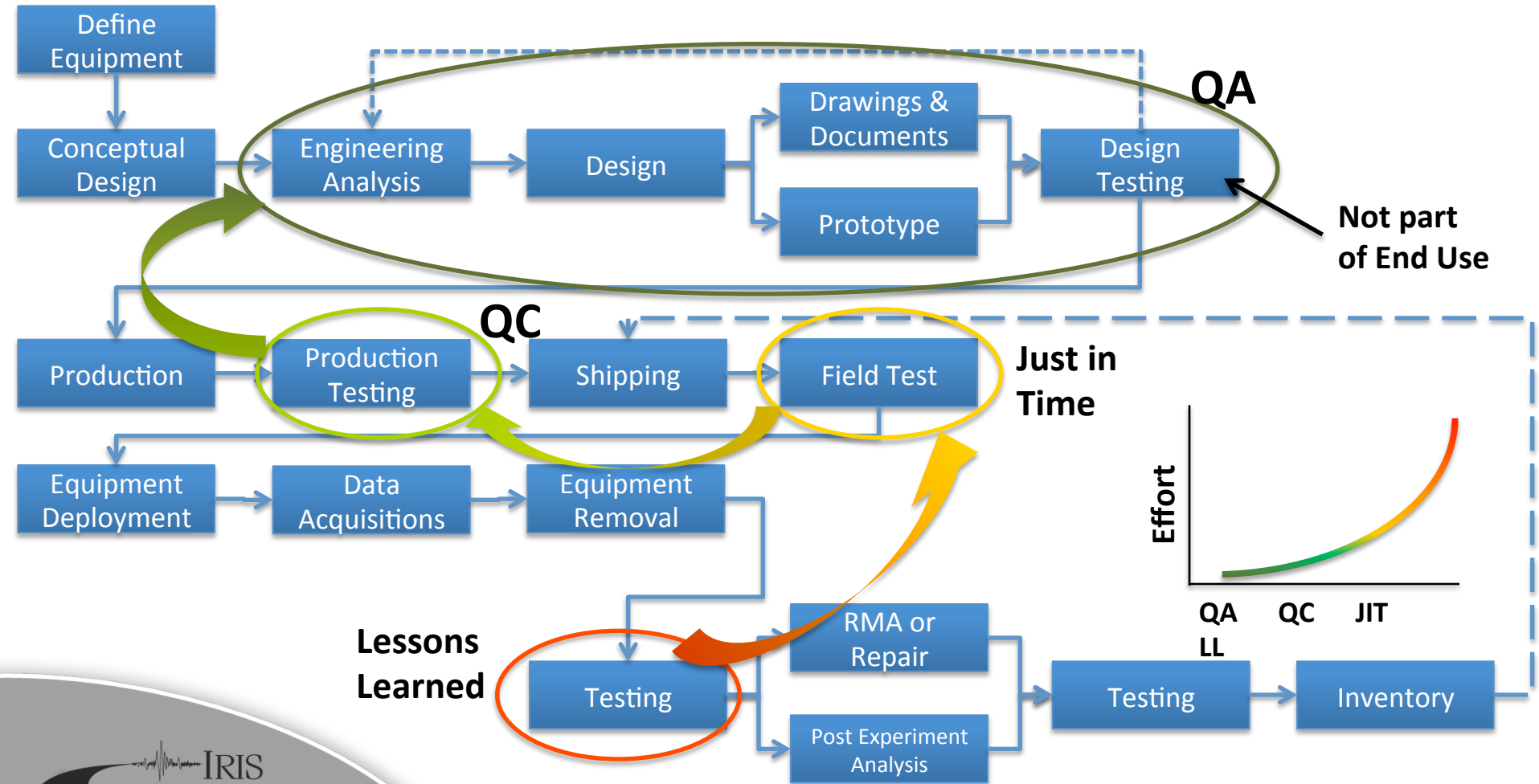
Equipment Life Cycle



Engineering Focus



Shifting Emphasis



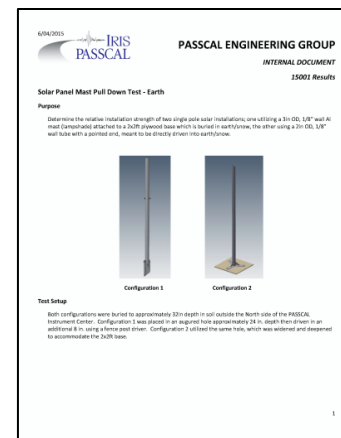
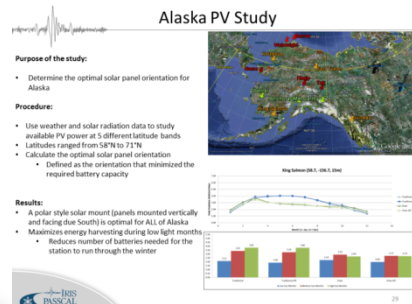
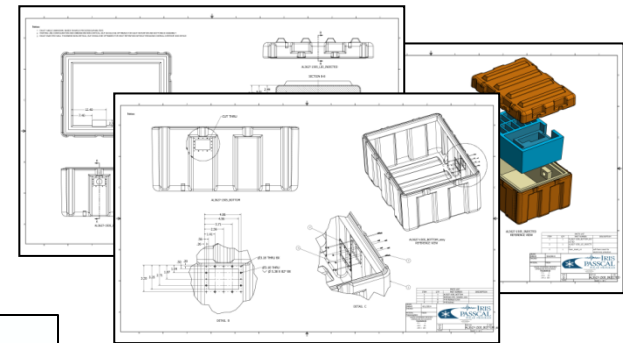
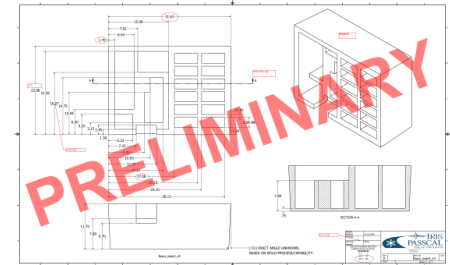
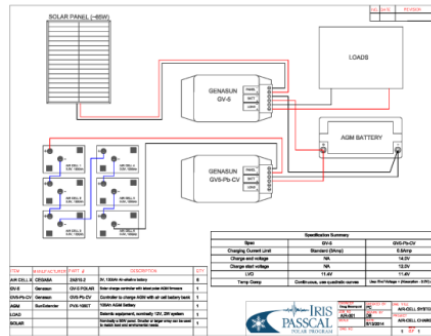
How Engineering = QA

Design process

- Change tracking
- Quality drawings
- Analysis and calculations
- Testing and revision
- Document results

Takes Time and Funding

- Prototypes, first articles, lab test, field test runs, etc



Long term Impact of Station Power Consumption

- Design decisions can make large long term impacts
- Design exercise of power consumption and impact over the life of the equipment
 - Reoccurring costs
 - Operational costs
 - Opportunity costs

Long term Impact of Station Power Consumption



Assumptions & other info

- 20 year life for capital equipment
- Equipment used each season
- Same equipment, designs and power performance over equipment life time
- Study does include
 - Reoccurring logistics cost
 - Station consumables
- Does not include all costs
 - Labor Not included
 - Other non-linear costs Not included

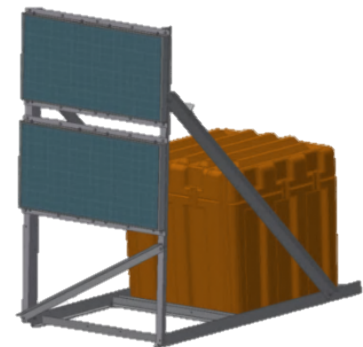
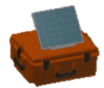
Studied

- 3 types of Polar stations & equipment

Long term Impact of Station Power Consumption

Scenarios

- Summer only deployed
 - Small rapid deploy enclosure, 7Ah rechargeable Li Battery, deployed twice per year, 40 total deployments
- Winter over, 2 Year deployment
 - Quick deploy station, 190Ah Primary Li Batteries, 10 total deployments
- Winter over, 5 Year deployment
 - Long-term station, 108Ah AGM batteries, 4 total deployments



Long term Impact of Station Power Consumption

Method

Station Power

- Station power draw -> Power storage needed -> battery qty & weight -> station size and material weight
- Consumables cost / W (Battery cost / W)
- Station weight / W

Logistics

- NM -> CA -> NZ -> MCM -> Station Install
 - All have a \$/lbs
 - Sum \$/lbs NM to Station Install
-
- Station weight per watt * logistics cost per lbs
 - Add consumables at cost per watt
 - \$/W per installed scenario
 - Installs per equipment life * \$/W per installed scenario = impact

Long term Impact of Station Power Consumption

- **Results**
- Reoccurring logistics cost and station consumables
- Summer only deployed
 - 75,000 \$/W over 20 years per station
- Winter over, 2 Year deployment
 - 50,000 \$/W over 20 years per station
- Winter over, 5 Year deployment
 - 80,000 \$/W over 20 years per station
- Does not capture all cost
 - 25% - 50%
 - Costs could be \$ or Opportunity

Acknowledgements

NSF: National Science Foundation

IRIS: Incorporated Research Institutions for Seismology

NMT: New Mexico Tech

USAP: United States Antarctic Program

ASC: Antarctic Support Contractor

PSF: Polar Field Services

