



GOES-R User Requirements Change Process

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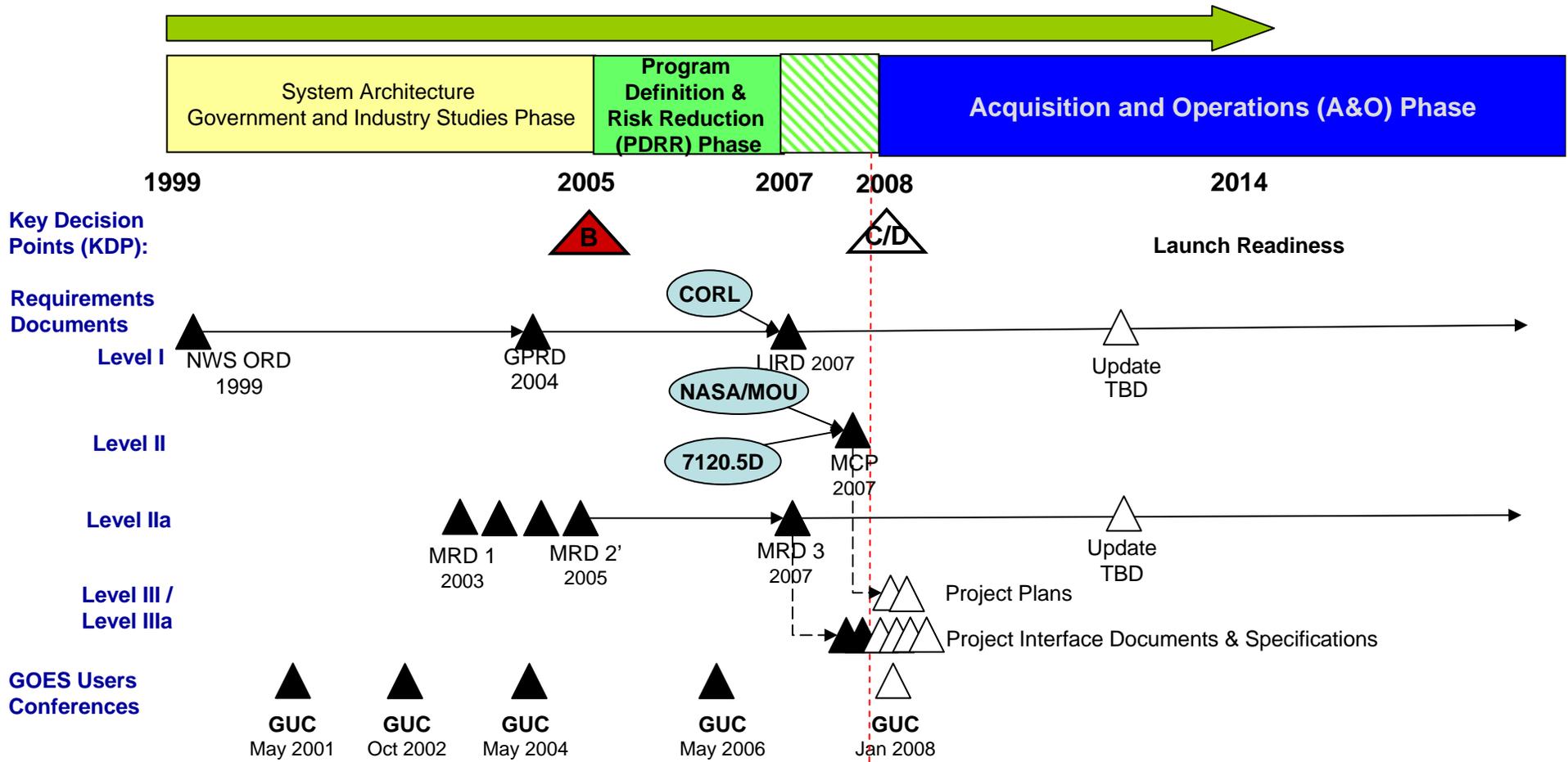
GOES-R Program Systems Engineering



GOES-R Requirements Evolution



REQUIREMENTS



ACRONYMS			
CORL	Consolidated Observational Requirements List	MOU	Memorandum of Understanding
GPRD	GOES Program Requirements Document	MRD	Mission Requirements Document
GUC	GOES Users Conference	ORD	Operational Requirements Document
LIRD	Level I Requirements Document	NWS	National Weather Service



NWS Operational Requirements Document (ORD) circa. 1999

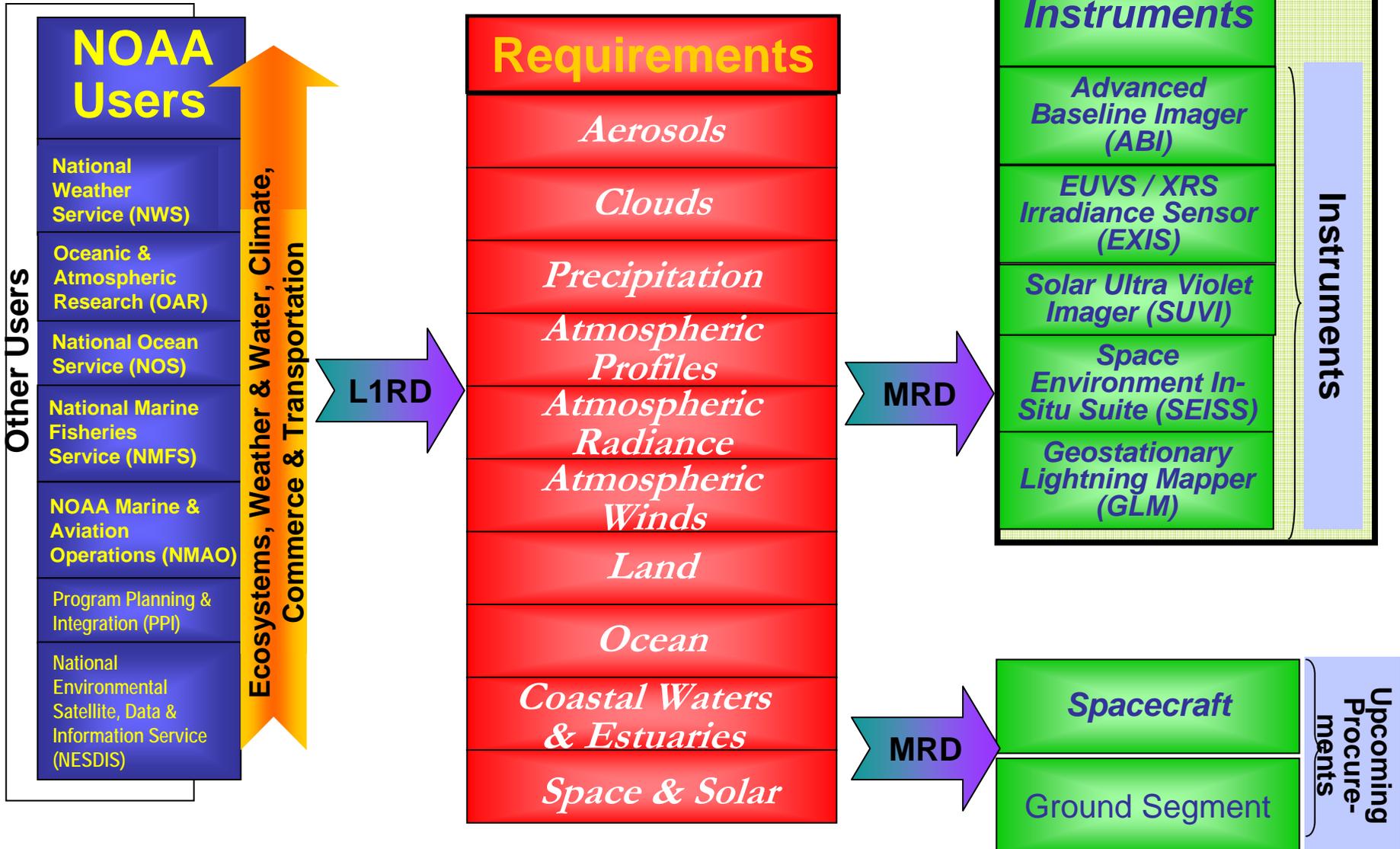


- Top Priorities

- ✓ Operation of sensors through eclipse and “keep-out-zones.”
- ✓ Resolution of imaging conflict among climatic, synoptic, and mesoscale requirements.
- ✓ Improved time and space resolution for the imager sensor.
- X Improved spatial coverage of the sounder sensor.



Mapping Requirements To GOES-R Approved System Solutions





GOES-R Requirements Process During Acquisition and Operations



- **Stability and clarity of requirements critical to successful implementation;**
- **As costs and implementation difficulties become apparent requirement updates may be necessary;**
- **Challenges for the Acquisition & Operations Phase:**
 - As products and services become available to the current series, these “Legacy” products must be integrated into the to-be-delivered GOES-R system.
 - As technologies mature and funding is made available, additional new products and services may be added.
 - As National priorities change, requirements will be reviewed and updated.



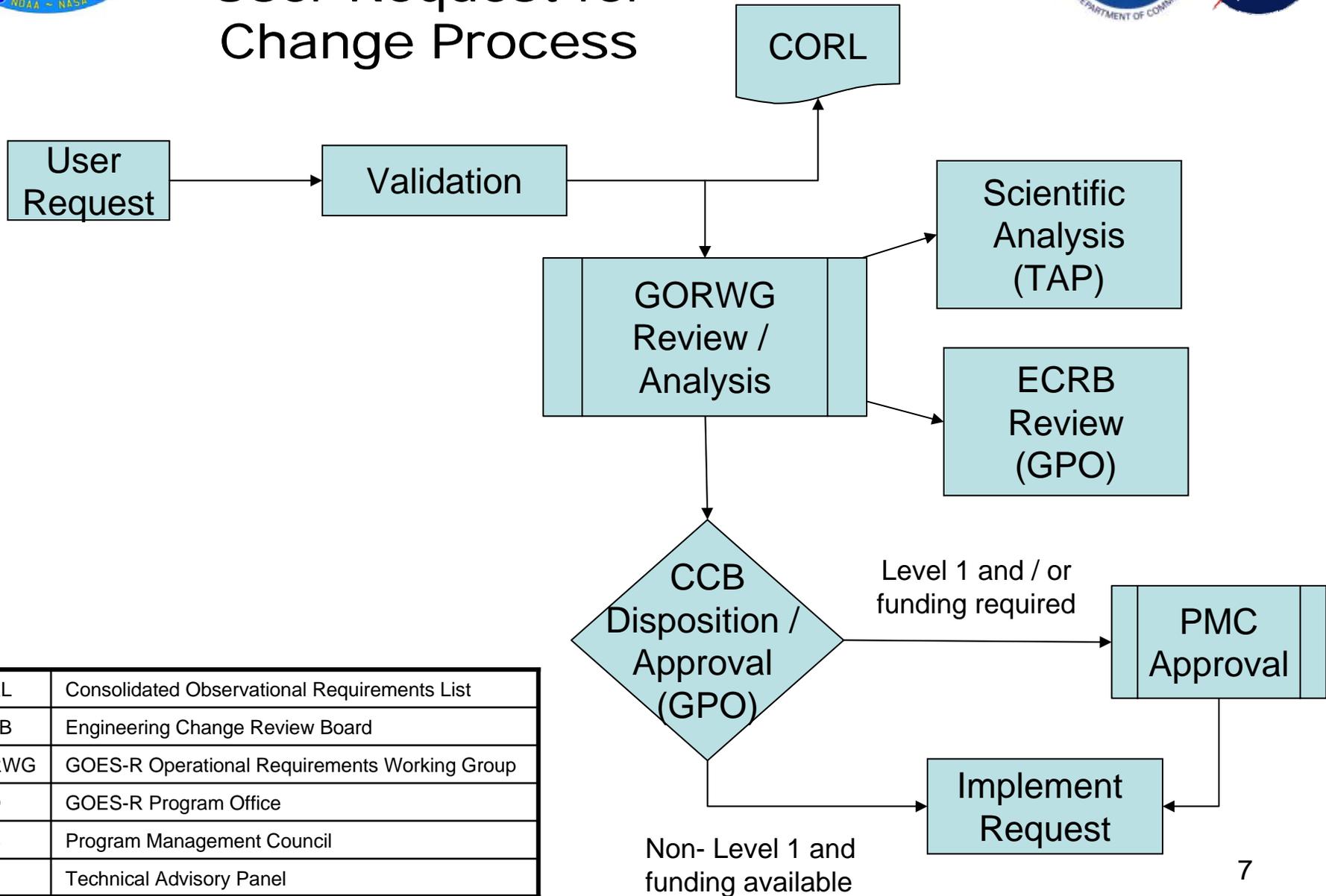
GOES-R Requirements Documents Hierarchy



Requirement Level	Baseline Document	Document Custodian & Control Process	Reviewing Body	Approving Body
NOAA Observing Systems Architecture (NOSA)	Consolidated Observational Requirements List (CORL)	NOAA Observing Systems Council (NOSC)	NOAA Observing Systems Council (NOSC)	NOAA Executive Council (NEC)
Level I	GOES-R Level I Requirements Documents	GOES-R Program Office (GPO)	NOSC, NOAA PMC, NESDIS AA/DAA	NOAA DUS
Level II	GOES-R Management Control Plan	GPO	NESDIS AA/DAA NASA/GSFC PMC	NESDIS AA, NASA/GSFC Center Director
Level IIa	Mission Requirements Document	GPO	GOES-R Operational Requirements Working Group (GORWG) GPO	GOES-R SPD
Level III	GOES-R Project Plans	GOES-R Projects	GPO	GOES-R SPD
Level IIIa	Project Level Interface Documents and Functional Specifications	GOES-R Projects	GPO	GOES-R Project Managers



User Request for Change Process



CORL	Consolidated Observational Requirements List
ECRB	Engineering Change Review Board
GORWG	GOES-R Operational Requirements Working Group
GPO	GOES-R Program Office
PMC	Program Management Council
TAP	Technical Advisory Panel



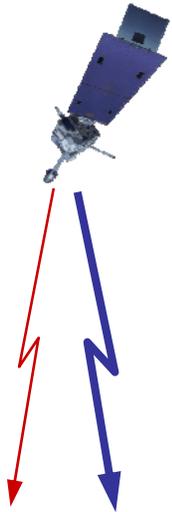
Example of a User Requirements Change Currently Under Consideration

Desired Growth in the capacity for the EMWIN and LRIT Communication Services

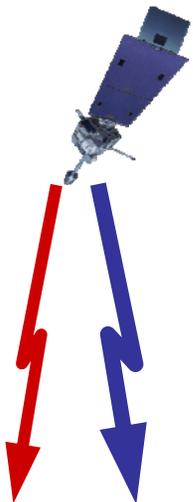
The Government's firm requirement will be defined in the draft solicitation
and subsequent final solicitation



EMWIN and LRIT Characteristics



- Currently the two services have separate broadcasts through each GOES satellite (East and West):
 - EMWIN:
 - 9.6Kbps FM signal, 1690.725 MHz (GOES I-M series)
 - 19.2 Kbps OQPSK CCSDS packetized signal, 1692.7 MHz (GOES NOP series)
 - Users utilize ~1 meter antenna
 - LRIT:
 - 128 Kbps BPSK CCSDS packetized signal, 1691.0 MHz
 - Users utilize ~1.2 meter antenna



- Both User communities desire greater capacity for more products

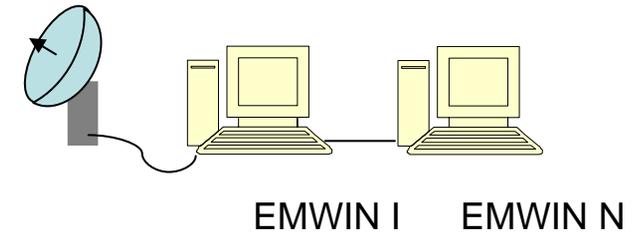
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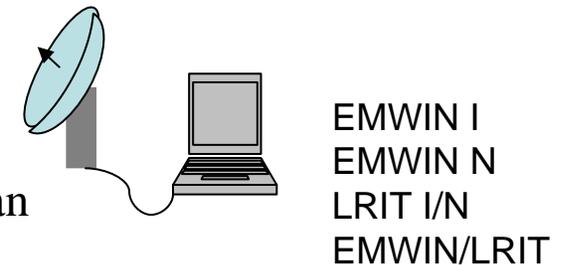
EMWIN and LRIT Concerns and Proposed Solution



- Concern about impact to cost, complexity and transition difficulties to higher data rate service
 - Bandwidth available for the entire GOES-R communications requirement is limited
 - Impact to Users terminals-- particularly for EMWIN
 - Must be very portable
 - Users have limited budget/resources



- Candidate GOES-R solution:
 - EMWIN and LRIT combined with a data rate greater than both current services
 - Design the satellite to transmit sufficient power that Users can still utilize ~1 meter antennas
 - Separate Virtual channels for each service--allow users to receive the content of either or both services
 - With software-based receiver technology, user terminals can be designed to receive all past and future formats with no hardware changes



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PROs and CONs



• BENEFITS:



- Allows desired increase in throughput capacity for both services.
- Allows commonality of user receive systems.
- Reduces cost/complexity of Spacecraft.
- Both Services retain the ability to use the same relatively small antennas with the new higher data rate.
- Reduces spectrum requirements:
 - Added benefit--allows critical S/C telemetry signal to be included in the GOES frequency band.

• CHALLENGES:



- Another change for the current users. However:
 - New frequencies are necessary, but the GRB broadcast requirement (31 Mbps) forces a reallocation of the L-band frequencies anyway.
 - New data rates are required to satisfy User-stated growth needs.
- Transition Concerns between legacy GOES and GOES-R

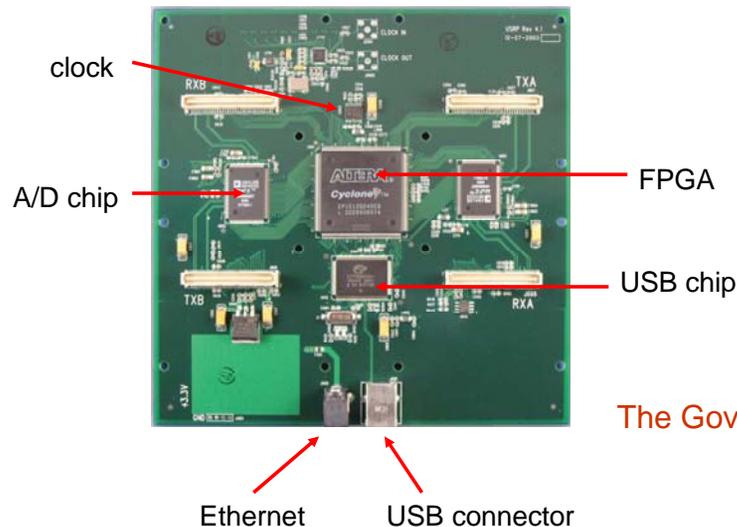
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User Concern Mitigation: Prototyping the solution



- The GOES-R Program plans to demonstrate a prototype very low cost EMWIN/LRIT receiver based on “Software Defined Radio” techniques which will:
 - Receive both services in any GOES I-M, N-P or –R+ frequencies, data rates and modulation types.
 - Receiver signal processing to be performed by a simple USB interface board in conjunction with a standard PC. Design for a prototype interface to be provided to the User community
 - Utilize GOES-R developed software--source code which would be available to the User communities.
 - Anticipate demonstration of a prototype in mid-2008.



**Ettus Universal Software Radio Peripheral (USRP)
early prototype**

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Impacts to Requirements Documentation

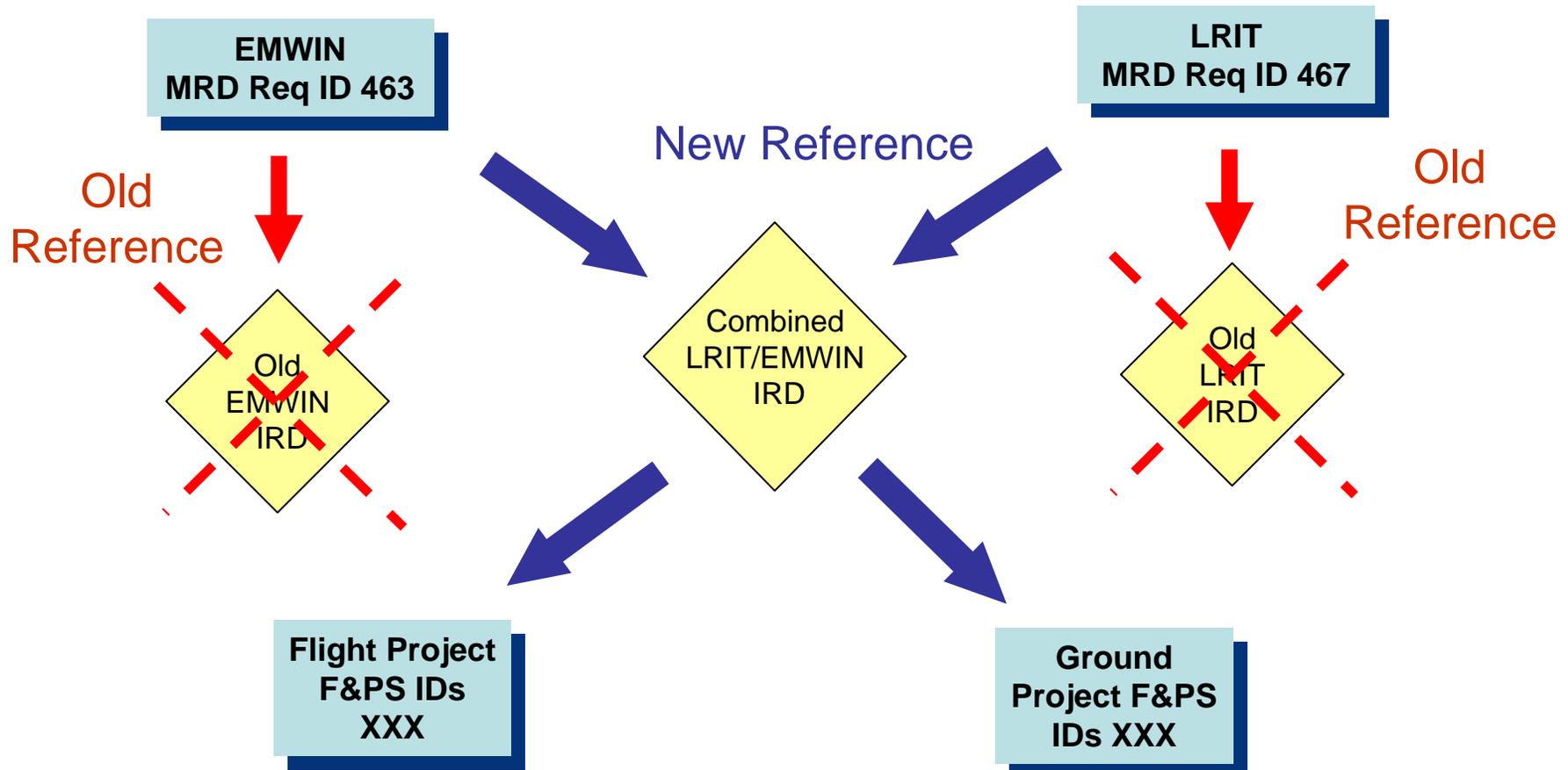


- The proposed solution still supports the EMWIN and LRIT services.
 - Therefore the Level 1 Requirements are unaffected
- The MRD defines the unique properties of EMWIN and LRIT through unique Spacecraft-to-Ground Interface Requirements Documents (IRDs).
 - Existing separate IRDs for EMWIN and LRIT (417-R-IRD-0004 & 417-R-IRD-0003) to be merged
 - A new IRD, for the combined service, is being created and will be referenced for both service requirements
- No cost impacts are required for implementation.
 - Savings on the satellite communication system will fund the development of the demonstration prototype.

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Impacts to Requirements Documentation (cont.)



End results: one spacecraft transponder, one common receive system

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Upcoming NOAA-sponsored Direct Read-out User Conference

December 8-12, 2008
Miami, Florida