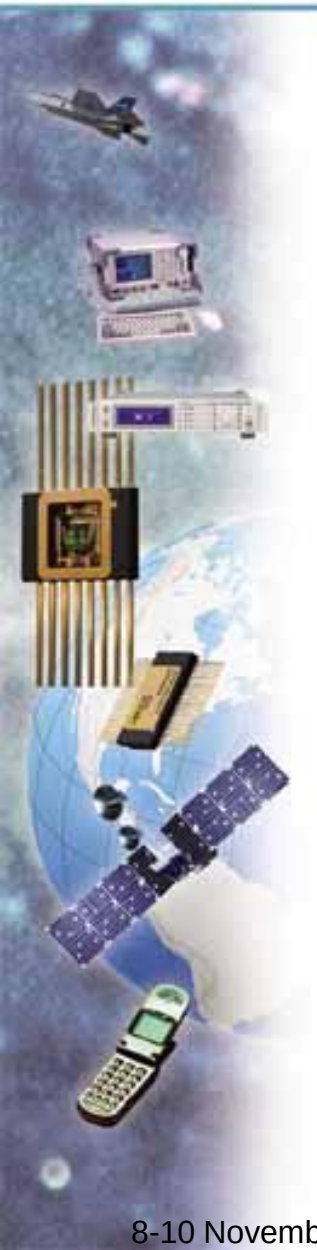

A 1553 TO SPACEWIRE BRIDGE

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Overview

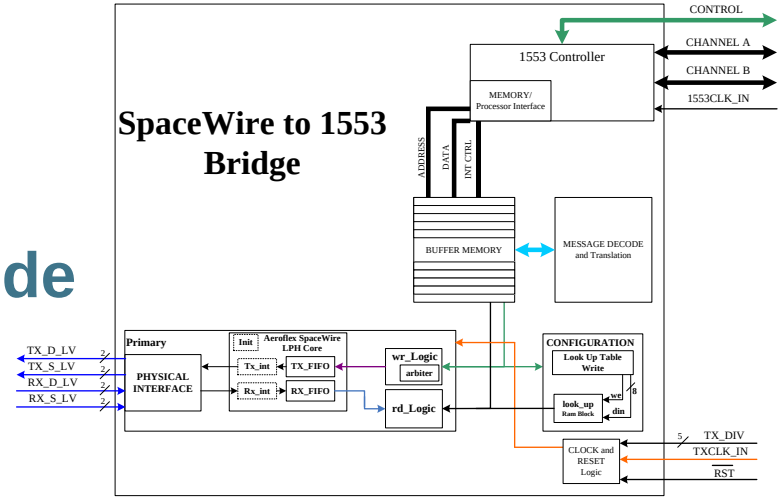
- Introduction
  - Legacy protocol devices used on SpaceWire Links
- 1553 to SpW Bridge Architecture
  - Requirements
  - Bridge Use
  - Notional Schematics
- Message Decode
- Example
- Conclusion

Introduction

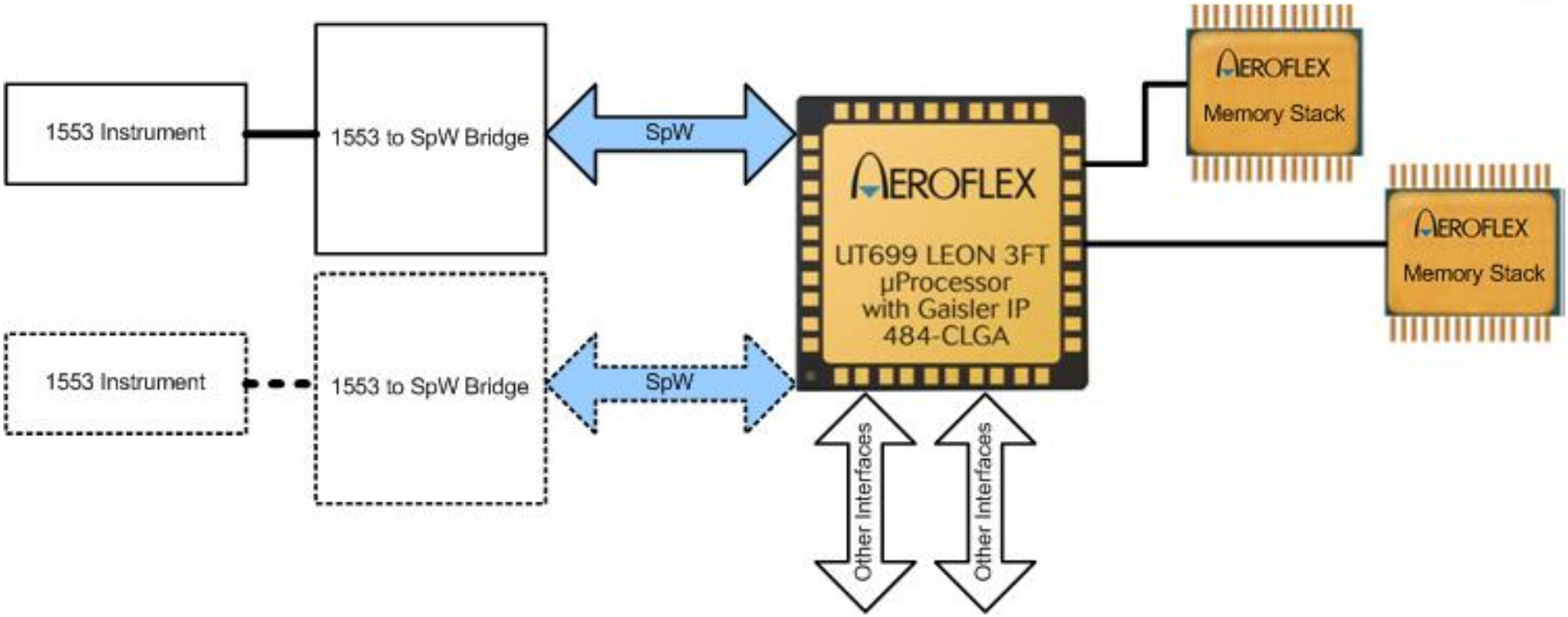
- **The 1553 to SpaceWire Bridge allows 1553 devices to communicate on a SpaceWire link**
  - **Increasing acceptance of SpW**
- **Allowing existing 1553 instruments to be used within a system where the main data bus has been updated to SpaceWire**
  - **Historic 1553 Instruments can be used as is**
- **MIL-STD-1553B messages are decoded and translated into ECSS-E-ST-50-12C and vice versa**

Architecture

- **Key Blocks of 1553 to SpW Bridge**
  - **SpaceWire Physical Interface**
    - One full duplex ECSS-E-ST-50-12C node
    - Targeted speeds of 10Mbps to 200Mbps
  - **A and B 1553 channels**
    - A and B half duplex MIL-STD-1553B
    - Communications at 1MHz
  - **1553 Control Bits**
    - Read, Write, Chip Select, Reset, etc..
  - **SpW and 1553 Message Decode**
    - BC and RT functions
  - **Required Buffer Memory**
    - FIFO Memory for Buffering 1553 Messages

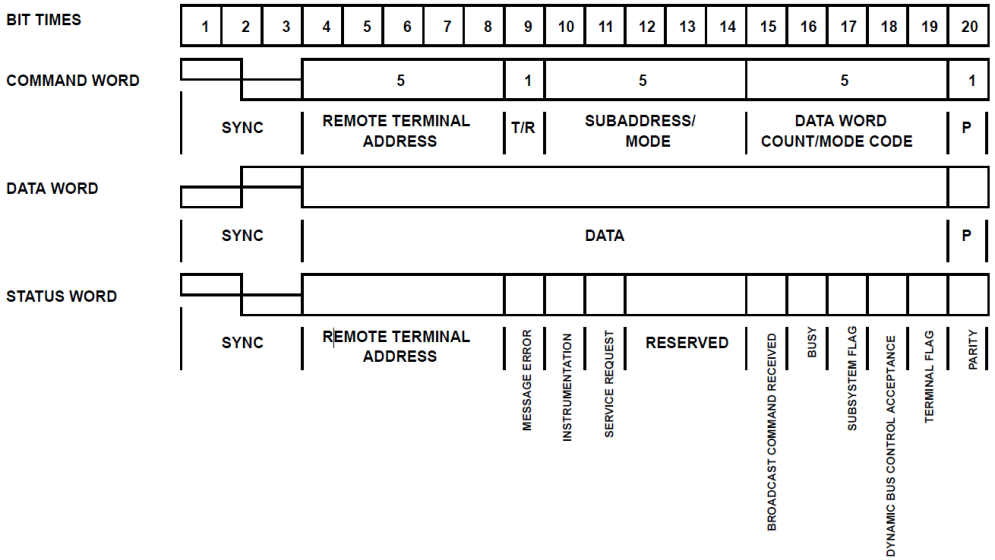


Bridge Use


1553 Instrument
1553 to SpW Bridge
SpW
AEROFLEX
UT699 LEON 3FT
µProcessor
with Gaisler IP
484-CLGA
AEROFLEX
Memory Stack
AEROFLEX
Memory Stack
1553 Instrument
1553 to SpW Bridge
SpW
Other Interfaces
Other Interfaces

Message Decode

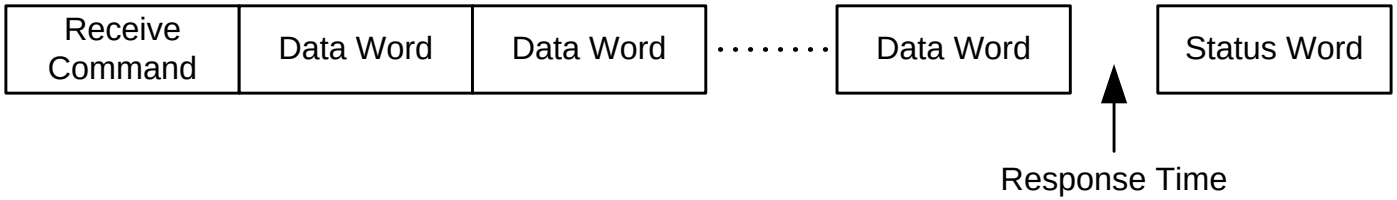
- **1553 to SpW bridge will translate 1553 messages into RMAP SpW packets**
- **Bus Controller (BC)- sends commands that direct the flow of data on the 1553 data bus**
- **Remote Terminal (RT)- electronics necessary to transfer data between the 1553 data bus and the external node**



	Target SpW Address	---	Target SpW Address
Target Logical Address	Protocol Identifier 0x01	Packet type, Command, Source Path Address Length	Key
Reply Address	Reply Address	Reply Address	Reply Address
Reply Address	Reply Address	Reply Address	Reply Address
Reply Address	Reply Address	Reply Address	Reply Address
Source Logical Addresses	Transaction Identifier MSB	Transaction Identifier LSB	Extended Write Address
Write Address MSB	Write Address	Write Address	Write Address LSB
Data Length MSB	Data Length	Data Length LSB	Header CRC
DATA	DATA	DATA	DATA
DATA	DATA	DATA	DATA
DATA	Data CRC	EOP	

Example

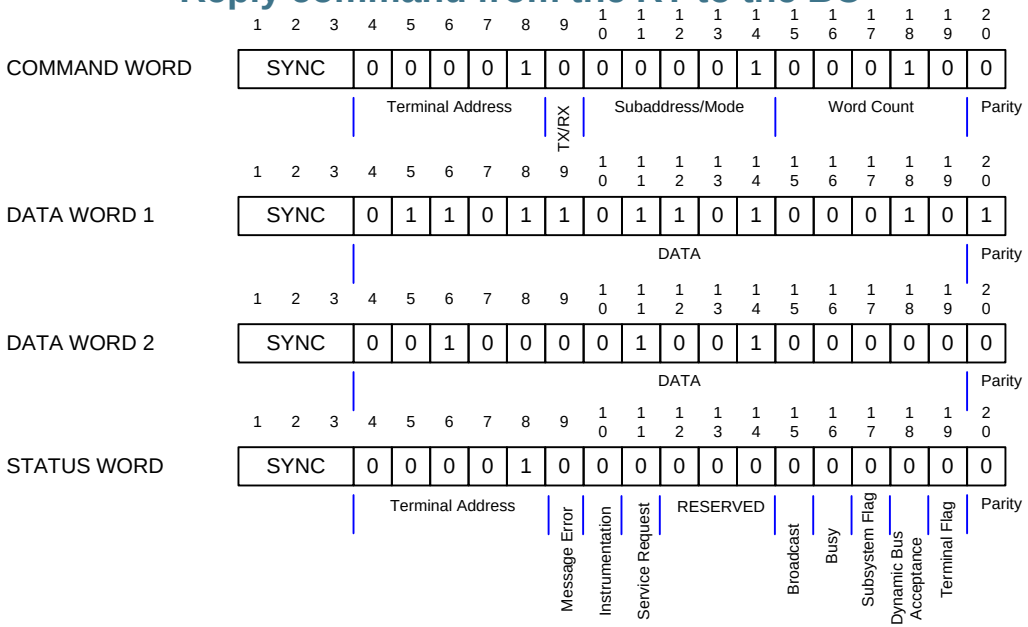
- **Assume a 1553 instrument wanted to send a BC-RT message**
  - **Information transfer format:**



- **The Bridge device ensures the COMMAND WORD, minus the SYNC and Parity bits, are placed in the first data bit of a RMAP Write command**
- **Depending on the overall network topology the RMAP packet will change**

Example cont.…

- **Data length bytes in the SpW RMAP Write will have to be set to accommodate for the 48-bit (0x30) 1553 BC-RT information transfer**
- **Converting from binary 1553 messages to Hex SpW RMAP commands: (minus the SYNC and parity bits)**
  - **Command Word: 00001000 00100010 = 0x08 0x22**
  - **Data Word 1: 01101101 10100010 = 0x6D 0xA2**
  - **Data Word 2: 00100001 00100000 = 0x21 0x20**
  - **Status Word: not part of the RMAP Write packet, this bit stream will be part of a Write Reply command from the RT to the BC**



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Reply Address	Reply Address	Reply Address	Reply Address
Source Logical Addresses	Transaction Identifier MSB	Transaction Identifier LSB	Extended Write Address
Write Address MSB	Write Address	Write Address	Write Address LSB
0x00	0x00	0x30	Header CRC
0x08	0x22	0x6D	0xA2
0x21	0x20	EOP	

Conclusion

- **The Aeroflex 1553 to SpW Bridge allows 1553 instruments to communicate on a SpaceWire bus**
  - **Allowing Legacy backplanes and system interconnects to be updated to SpW**
- **RMAP commands are used to bridge information from a SpaceWire bus to a 1553 bus**
- **This Bridge device provides a solution that translates between 1553 and the SpaceWire busses**
- **Redesign of proven 1553 instruments is not required**

Parameter	1553	SpaceWire
Data Rate	1 MHz	up to 400Mbps
Word Length	20 bits	User Defined
Data Bits / Word	16 bits	User Defined
Message Length	Maximum of 32 data words	User Defined
Transmission Technique	Half-duplex	Full-Duplex
Protocol	Command/response	RMAP
Bus Control	Single or Multiple	Point-to-Point

References

- Aeroflex Colorado Springs, "1553 Product Handbook," October 1992
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- IEEE P1355, "Standard for Heterogeneous InterConnect (HIC) IEEE 1355-1995," Conference Title, Location, June 12, 1996
- ESA Publications Division, "SpaceWire Standard Document ECSS-E-ST-50-12C," The Netherlands, July 30, 2008
- ESA Publications Division, "Remote Memory Access Protocol (RMAP) ECSS-S-ST-50-52C," The Netherlands, February 2010