LEVEL	NAME	DESCRIPTION	EXAMPLES
1	PHYSICAL CONTROL	SPECIFIES THE ACTUAL MEANS OF SYMBOL TRANSMISSION ACROSS A PHYSICAL MEDIUM	RS 232 C, RS 422/423, NASA RF & EMISSION STANDARDS
2	LINK CONTROL	ENABLES LOGICAL SEQUENCES OF MESSAGES TO BE EXCHANGED RELIABLY ACROSS A SINGLE PHYSICAL DATA LINK	BI SYNC, SDLC, HDLC, ADCCP, TELEMETRY ERROR CORRECTING CODING STANDARDS
3	NETWORK CONTROL	PROVIDES LOGICAL CHANNELS CAPABLE OF RELIABLY TRANSFERRING INFORMATION BETWEEN TWO END POINTS OF A SINGLE COMMUNICATIONS NETWORK	X.25, NASCOM BLOCK STANDARD
4	TRANSPORT END-TO-END CONTROL	PROVIDES RELIABLE ENDPOINT-TO-ENDPOINT TRANSPORT OF MESSAGES ACROSS AN ARBITRARY CONFIGURATION SPANNING SEVERAL INTER CONNECTED NETWORKS.	CURRENTLY BEING DEFINED

Fig. 5. Level Hierarchy: ANSI Reference Model For Distributed Systems.

computed over the entire packet. The packet length would be selected by the instrument designer from a set of standard values. The spacecraft data system would gather packets from each source as they become adaptively created by the instrument and assemble them into Level 3 transport frames for transmission through the delivery network to the user on the ground. The transport frames would be of fixed length and would consist of a standard header, a data field which contains either an entire source packet or a contiguous segment of a packet, and a trailer containing an error-detecting parity code computed over the entire frame. This transport process is shown in Figure 6 which also indicates how a portion of the source header would "echo" in each transport frame in order to produce a composite transport header which displays full characteristics of autonomy.

The Draft Protocols

Standards for the source packet and transport frame protocols are presently being developed within the NEEDS program and efforts are being made to design these protocols to be compatible with currently developing national and international standards. A recent draft version of the standards is shown in Figure 7.

The source packet contains a mandatory primary header and an optional secondary header. The primary header contains identification of the source instrument (split into two separate fields to provide burst-error protection) as well as specification of the mission on which the instrument is being flown. The remaining fields identify the sequence number of the packet as it is generated by the source, the total length of the packet, and the format of any secondary header. Standards for the secondary header are presently undefined but we foresee that ancillary data such as spacecraft measurement time and pointing information, supplied to the instrument by the spacecraft data system, will be inserted here. The trailer containing packet parity will probably be generated using the same polynomial as commercial ground systems.

The transport frame header begins with a pseudonoise synchronization code followed by a field which defines the transmission mode of the delivery network. Next is a sequence count defining the serial number of the frame as it is generated by the spacecraft data system and after this is a field specifying any "options" selected in the format of the frame itself: one of these options includes the capability to insert one or more 16-bit words in the header for certain network control purposes. The header will also define which portion (or "segment") of a particular source packet is transported within the frame. The