SCIENCE INSTRUMENTATION PACKAGE, LST

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At Goddard we have three LST-related RTOPs and I have selected one for discussion today; namely, the Optical Instrument System for the Large Space Telescope (LST).

I chose this particular RTOP for two reasons. First of all, it is the one that is the furthest along technically, and therefore, we can present more results than on any of the others.

Secondly, I want to speak on this RTOP because it represents the heart of our participation in the LST program with Marshall Space Flight Center. As you are undoubtedly aware, Marshall has project responsibility for the LST and will be supplying the spacecraft and the telescope. Goddard is responsible for providing the science instrumentation package, as well as mission and data operations.

To begin with, about a year ago the LST Science Steering Committee issued a series of recommendations. These recommendations were combined with certain mission constraints to produce a set of scientific objectives. We took these scientific objectives and integrated them with a Goddard pre-Phase-A Instrument Design Study, added certain spacecraft constraints which we got from Marshall Space Flight Center, and produced a series of parametric science instrumentation package designs.

These parametric science package designs were gradually reduced to a reference science instrumentation package design for the Phase-A study. That reference design is the one that I will be discussing.

Overlaying this entire process was a directive from the program scientist and the Science Steering Committee that we produce a dynamic, flexible science instrument package design for use in a national astronomical space observatory during the entire decade of the 1980s.

Let's begin with Figure 1 and take a look at the recommended instruments from the Science Steering Committee.

As you can see, the instruments are broken into two categories. First of all, let's examine the primary category, which consists of the three instruments shown. The primary category is defined as instruments which must be in any LST.

The secondary category which was designated by the Steering Committee is defined as instruments which should be put on the LST on an "as available" basis. I use the term "as available" to mean if we have the weight, power, money, and space to put them in.

PRIMARY	I	DIFFRACTION LIMITED CAMERA	
	II	LOW DISPERSION SPECTROGRAPH	
	III	HIGH DISPERSION SPECTROGRAPH	
SECONDARY		ASTROMETRIC MACHINES	
		PHOTOMETERS	HIGH TIME RESOLUTION
			HIGH INTRINSIC ACCURACY
		POLARIMETERS	
		F/12 CAMERA	
		FOURIER INTERFEROMETER	
		INFRARED INSTRUMENTATION	
		VERY HIGH DISPERSION SPECTROGRAPH	

Figure 1. LST steering committee instrument recommendations.

Figure 2 is a pictorial version of the Phase-A design of the science instrumentation package.

First of all, the telescope is located to the left, with light travelling from left to right. The instruments are shown in their respective locations within the science instrumentation package design. This particular design was set up so that the instruments are located for independent removal or refurbishment during the life of the mission.

Instruments between the first and second structural rings are removed radially, and instruments between the second and third structural rings are removed axially.

The structure between the first and the second rings is generally referred to as the focal plane structure, and the structure between the second and third rings is called the science instrumentation package (SIP) aft structure.

Figure 3 is a functional block diagram of the science instrumentation package. The area between the first and second structural rings, or the focal-plane structure, is shown in this block; and located there we also find three of the four instruments which make up the faint object spectrograph; the fourth instrument is located in the aft SIP structure.

At this point is is important to note that it was impossible to design a single instrument that would operate over the entire wavelength that was recommended by the Science Steering Committee. For this reason we actually have four separate instruments making up the faint object spectrograph.

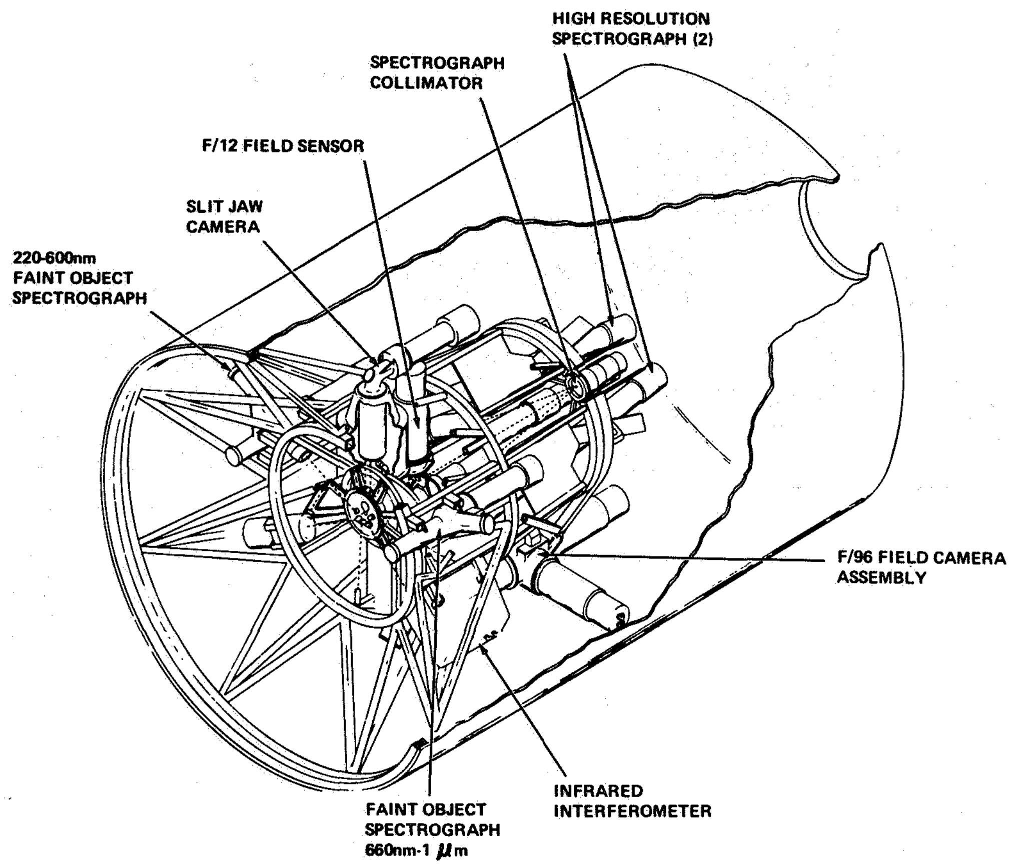

Figure 2. Scientific instrument package.

In the focal plane structure, you find the F-12 camera. This is the only secondary instrument which we are packaging from the list of secondary instruments provided by the Science Steering Committee.

In the aft SIP structure, we have the high-resolution spectrograph, as well as an unassigned bay, that is to say, room for an as yet undesignated or unassigned instrument.

In addition, in the area of the science instrumentation package you see the third or final of the primary instruments recommended by the Science Steering Committee, the diffraction limited camera. The diffraction limited camera consists of a single set of optics, but again requires three sensors to operate over the entire range that was recommended by the Science Steering Committee.

In conclusion, I would like to say that the results of our study showed that we could produce a dynamic, flexible package for use in a national astronomical space observatory during the 1980s. Such a design would incorporate all of the primary instruments that were recommended by the Science Steering Committee, as well as at least two of the secondary instruments.

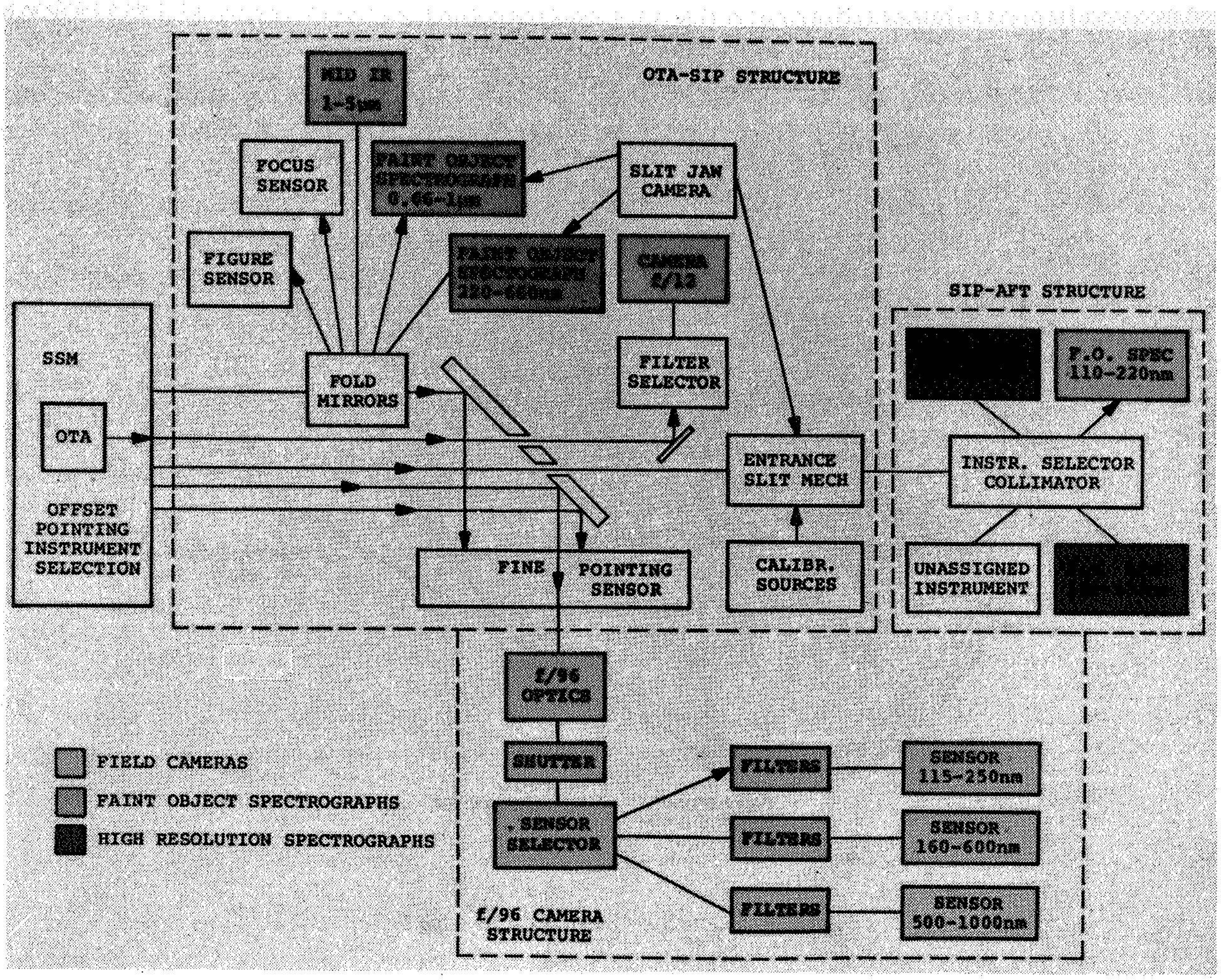

Figure 3. Scientific instrument package functional block diagram.