	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1	**Engineering & Technology Development**										**5-YEAR TOTALS**					ARK 28 OCT 2004						♥	
2																							
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Line	Line	Topic Totals		Topic Totals		Topic Totals	
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	Totals	Totals	**All projects**		**Priority 1 projects**		**Priority 1+2 projects**	
5								engineers	engineers							$	FTE	$	FTE	$	FTE	$	FTE
6	**1**	**Antenna R & D**																**$431,000**	**42.5**	**$146,000**	**12.5**	**$431,000**	**42.5**
7	1.1				Focal plane arrays	1	2.5	5	0	5	$50,000	$0	$0	$10,000	$5,000	$65,000	12.5						
8	1.2				Metrology	2	2.5	5	0	5	$150,000	$0	$0	$20,000	$10,000	$180,000	12.5						
9	1.3				Ultra-Wideband Feeds	2	2.5	10	0	5	$75,000	$0	$0	$20,000	$10,000	$105,000	17.5						
10	1.4				Physical Optics	1	0	0	0	0	$0	$0	$0	$6,000	$75,000	$81,000	0.0						
11																							
12	**2**	**Receiver Technology**																					
13	**2.1**		**Amplifiers**			2	0	5	0	10	$100,000	$500,000	$0	$20,000	$20,000	$640,000	15.0	**$1,690,000**	**58.8**	**$0**	**0.0**	**$1,500,000**	**55.0**
14	2.1.2				MMIC Technology	2	0	10	0	15	$250,000	$0	$0	$20,000	$20,000	$290,000	25.0						
15	2.1.3				Noise theory HFETs	2	0	2.5	0	1.25	$175,000	$0	$0	$10,000	$5,000	$190,000	3.8						
16	2.1.4				1/f noise in HFETs	2	0	2.5	0	1.25	$175,000	$0	$0	$10,000	$5,000	$190,000	3.8						
17	2.1.5				Noise in bipolars	3	0	2.5	0	1.25	$175,000	$0	$0	$10,000	$5,000	$190,000	3.8						
18	2.1.6				InP HBT technology	2	0	2.5	0	5	$175,000	$0	$0	$10,000	$5,000	$190,000	7.5						
19	**2.2**		**SIS Mixers**																				
20	2.2.2				Technology Dev for 780-950 GHz Heterodyne Rx	1	2.45	0.55	0.5	1.9	$16,500	$0	$1,040,000	$4,000	$0	$1,060,500	5.4	**$1,060,500**	**5.4**	**$1,060,500**	**5.4**	**$1,060,500**	**5.4**
34	2.2.3				New materials for SIS mixers	3	0.6	0.1	0	0.6	$0	$122,000	$1,500,000	$0	$0	$1,622,000	1.3	**$1,622,000**	**1.3**	**$0**	**0.0**	**$0**	**0.0**
38	**2.3**		**Specific Receiver Systems**																				
39	2.3.1				Continuum Radiometer Development	3	0	2.75	0	3.3	$0	$464,200	$0	$0	$0	$464,200	6.1	**$464,200**	**6.1**	**$0**	**0.0**	**$0**	**0.0**
48	2.3.2				1.4 THz Receiver	3	0	2.65	0	1.6	$0	$427,000	$0	$0	$0	$427,000	4.3	**$427,000**	**4.3**	**$0**	**0.0**	**$0**	**0.0**
60	**2.4**		**LO & Signal Sources**															**$1,280,000**	**42.5**	**$0**	**0.0**	**$1,280,000**	**42.5**
61	2.4.1				Highly integrated multiplier chains	2	0	5	0	10	$200,000	$0	$0	$20,000	$10,000	$230,000	15.0						
62	2.4.2				Photonic LO	2	2.5	10	0	15	$500,000	$500,000	$0	$25,000	$25,000	$1,050,000	27.5						
63	**2.5**		**Cryogenics**															**$240,000**	**20.0**	**$0**	**0.0**	**$240,000**	**20.0**
64	2.5.1				New cryogenic technology	2	0	2.5	0	7.5	$75,000	$0	$0	$20,000	$10,000	$105,000	10.0						
65	2.5.2				Cryocoolers	2	0	2.5	0	7.5	$100,000	$0	$0	$25,000	$10,000	$135,000	10.0						
66	**2.6**		**Other receiver & measurement technology**															**$350,000**	**20.0**	**$0**	**0.0**	**$350,000**	**20.0**
67	2.6.1				Wideband components	2	0	2.5	0	2.5	$100,000	$0	$0	$25,000	$30,000	$155,000	5.0						
68	2.6.2				Integration feeds & amplifiers	2	0	5	0	10	$150,000	$0	$0	$20,000	$25,000	$195,000	15.0						
69																							
70	**3**	**Signal Processing and Transmission**																**$2,865,000**	**117.8**	**$1,765,000**	**33.8**	**$2,695,000**	**105.3**
71	**3.1**		**Digital transmission**			2	0	5	0	10	$40,000	$0	$0	$20,000	$10,000	$70,000	15.0						
72	**3.2**		**Satellite-based LO reference**			2	2.5	2.5	0	5	$100,000	$0	$0	$10,000	$10,000	$120,000	10.0						
73	**3.3**		**Wide bandwidth digitization**			1	2.5	3.75	0	5	$100,000	$0	$0	$500,000	$25,000	$625,000	11.3						
74	**3.4**		**RFI Mitigation**																				
75	3.4.1				General	2	2.5	7.5	0	5	$150,000	$0	$0	$50,000	$20,000	$220,000	15.0						
76	3.4.2				Digital Filtering	2	0	10	0	5	$75,000	$0	$0	$0	$115,000	$190,000	15.0						
77	3.4.3				Spatial Nulling	2	5	0	0	0	$20,000	$0	$0	$10,000	$5,000	$35,000	5.0						
78	3.4.4				Blanking and Adaptive Cancellation	2	2.5	2.5	0	0	$75,000	$0	$0	$50,000	$100,000	$225,000	5.0						
79	3.4.5				Signal Propagation	2	2.5	1.5	0	2.5	$0	$50,000	$0	$10,000	$10,000	$70,000	6.5						
80	**3.5**		**Advanced digital correlators**			1	2.5	10	0	10	$230,000	$0	$500,000	$400,000	$10,000	$1,140,000	22.5						
81	**3.6**		**Water Vapor Radiometers**			3	2.5	5	0	5	$150,000	$0	$0	$10,000	$10,000	$170,000	12.5						
82																							
83																							
84																**Total M&S**	**Total FTE**						
85			**All projects, funds permitting**			1,2 & 3	**35.6**	**126.3**	**0.5**	**156.2**	**$3,406,500**	**$2,063,200**	**$3,040,000**	**$1,335,000**	**$585,000**	**$10,429,700**	**319**						
86																							
87																**Total M&S**	**Total FTE**						
88			**Priority 1 projects, minimum funding**			1	**10.0**	**19.3**	**0.5**	**21.9**	**$396,500**	**$0**	**$1,540,000**	**$920,000**	**$115,000**	**$2,971,500**	**52**						
89																							
90																**Total M&S**	**Total FTE**						
91			**Priority 1 and 2 projects**			1 & 2	**32.5**	**113.3**	**0.5**	**144.4**	**$3,081,500**	**$1,050,000**	**$1,540,000**	**$1,315,000**	**$570,000**	**$7,556,500**	**291**						
92																							

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Engineering & Technology Development**										**2005**				ARK 28 OCT 2004		
2																	
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Section	Section
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	FTE	Cost
5								engineers	engineers							Totals	Totals
6	**1**	**Antenna R & D**															
7	1.1		Focal plane arrays			1	0.5	1		1	$10,000			$2,000	$1,000	2.50	$13,000
8	1.2		Metrology			2	0.5	1		1	$30,000			$4,000	$2,000	2.50	$36,000
9	1.3		Ultra-Wideband Feeds			2	0.5	2		1	$15,000			$4,000	$2,000	3.50	$21,000
10	1.4		Physical Optics			1								$6,000	$15,000	0.00	$21,000
11																	
12	**2**	**Receiver Technology**															
13	**2.1**		**Amplifiers**			2		1		2	$20,000	$100,000		$4,000	$4,000	3.00	$128,000
14	2.1.2			MMIC Technology		2		2		3	$50,000			$4,000	$4,000	5.00	$58,000
15	2.1.3			Noise theory HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
16	2.1.4			1/f noise in HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
17	2.1.5			Noise in bipolars		3		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
18	2.1.6			InP HBT technology		2		0.5		1	$35,000			$2,000	$1,000	1.50	$38,000
19	**2.2**		**SIS Mixers**														
20	2.2.2			Technology Dev for 780-950 GHz Heterodyne Rx		1										2.85	$423,000
21					Mixer design	1	0.8			0.2			$12,000				
22					Magnetic circuit	1		0.15					$3,000				
23					LO injection	1	0.2										
24					Signal optics	1	0.1			0.1			$5,000				
25					Dewar customization	1		0.1		0.2							
26					FTS measurements	1	0.05	0.05		0.05							
27					Mixer measurements	1	0.2		0.1	0.2							
28					Preamps	1		0.1		0.2							
29					LO and signal source	1	0.05						$100,000				
30					Computer & peripherals	1											
31					NbTiN development & wafer fabrication	1							$300,000				
32					Misc. hardware & materials	1					$3,000						
33					Consumables (LN, LHe)	1											
34	**2.2.3**			**New materials for SIS mixers**		3										0.10	$300,000
35					1.4 THz signal source	3											
36					Optics	3											
37					Material development & wafer fabrication	3	0.1						$300,000				
38	**2.3**		**Specific Receiver Systems**														
39	**2.3.1**			**Continuum Radiometer Development**		3										3.20	$365,200
40					SIS continuum Rx (based on existing mxr.)	3		0.1									
41					Instrumented dewar, pumps, etc.	3		0.2		0.3		$110,000					
42					Compressor & Crosshead	3				0.3		$55,000					
43					Control rack	3				1		$79,200					
44					IF components	3		0.1		0.3		$33,000					
45					SIS mixers (6)	3				0.3							
46					Preamps (6)	3				0.3							
47					LO and signal source	3		0.1		0.2		$88,000					
48	**2.3.2**			**1.4 THz Receiver**		3										0.10	$0
49					Mixer development	3		0.1									
50					FTS	3											
51					Instrumented dewar, pumps, etc.	3											
52					Compressor & Crosshead	3											
53					Control rack	3											
54					IF components	3											
55					Optics	3											
56					SIS mixers (6)	3											
57					Preamps (6)	3											
58					LO source	3											
59					Magnetic circuit design & software	3											
60	**2.4**		**LO & Signal Sources**														
61	2.4.1			Highly integrated multiplier chains		2		1	0	2	$40,000			$4,000	$2,000	3.00	$46,000
62	2.4.2			Photonic LO		2	0.5	2	0	3	$100,000	$100,000		$5,000	$5,000	5.50	$210,000
63	**2.5**		**Cryogenics**														
64	2.5.1			New cryogenic technology		2		0.5	0	1.5	$15,000			$4,000	$2,000	2.00	$21,000
65	2.5.2			Cryocoolers		2		0.5	0	1.5	$20,000			$5,000	$2,000	2.00	$27,000
66	**2.6**		**Other receiver & measurement technology**														
67	2.6.1			Wideband components		2		0.5		0.5	$20,000			$5,000	$6,000	1.00	$31,000
68	2.6.2			Integration feeds & amplifiers		2		1		2	$30,000			$4,000	$5,000	3.00	$39,000
69																	
70	**3**	**Signal Processing and Transmission**															
71	3.1		Digital transmission			2		1	0	2	$8,000			$4,000	$2,000	3.00	$14,000
72	3.2		Satellite-based LO reference			2	0.5	0.5		1	$20,000			$2,000	$2,000	2.00	$24,000
73	3.3		Wide bandwidth digitization			1	0.5	0.75		1	$20,000			$100,000	$5,000	2.25	$125,000
74	**3.4**		**RFI Mitigation**														
75	3.4.1			General		2	0.5	1.5	0	1	$30,000			$10,000	$4,000	3.00	$44,000
76	3.4.2			Digital Filtering		2		2		1	$15,000				$23,000	3.00	$38,000
77	3.4.3			Spatial Nulling		2	1				$4,000			$2,000	$1,000	1.00	$7,000
78	3.4.4			Blanking and Adaptive Cancellation		2	0.5	0.5			$15,000			$10,000	$20,000	1.00	$45,000
79	3.4.5			Signal Propagation		2	0.5	0.3		0.5		$10,000		$2,000	$2,000	1.30	$14,000
80	**3.5**		**Advanced digital correlators**			1	0.5	2	0	2	$50,000		$100,000	$80,000	$2,000	4.50	$232,000
81	**3.6**		**Water Vapor Radiometers**			3	0.5	1	0	1	$30,000			$2,000	$2,000	2.50	$34,000
82																	
83																	
84																**Total M&S**	**Total FTE**
85			**All projects, funds permitting**			1,2 & 3	**8.0**	**25.1**	**0.1**	**33.4**	**$685,000**	**$575,200**	**$820,000**	**$271,000**	**$117,000**	**$2,468,200**	**67**
86																	
87																**Total M&S**	**Total FTE**
88			**Priority 1 projects, minimum funding**			1	**2.9**	**4.2**	**0.1**	**5.0**	**$83,000**	**$0**	**$520,000**	**$188,000**	**$23,000**	**$814,000**	**12**
89																	
90																**Total M&S**	**Total FTE**
91			**Priority 1 and 2 projects**			1 & 2	**7.4**	**23.0**	**0.1**	**29.5**	**$620,000**	**$210,000**	**$520,000**	**$267,000**	**$114,000**	**$1,731,000**	**60**
92																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Engineering & Technology Development**										**2006**				ARK 28 OCT 2004		
2																	
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Section	Section
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	FTE	Cost
5								engineers	engineers							Totals	Totals
6	**1**	**Antenna R & D**															
7	1.1		Focal plane arrays			1	0.5	1		1	$10,000			$2,000	$1,000	2.50	$13,000
8	1.2		Metrology			2	0.5	1		1	$30,000			$4,000	$2,000	2.50	$36,000
9	1.3		Ultra-Wideband Feeds			2	0.5	2		1	$15,000			$4,000	$2,000	3.50	$21,000
10	1.4		Physical Optics			1									$15,000	0.00	$15,000
11																	
12	**2**	**Receiver Technology**															
13	**2.1**		**Amplifiers**			2		1		2	$20,000	$100,000		$4,000	$4,000	3.00	$128,000
14	2.1.2			MMIC Technology		2		2		3	$50,000			$4,000	$4,000	5.00	$58,000
15	2.1.3			Noise theory HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
16	2.1.4			1/f noise in HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
17	2.1.5			Noise in bipolars		3		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
18	2.1.6			InP HBT technology		2		0.5		1	$35,000			$2,000	$1,000	1.50	$38,000
19	**2.2**		**SIS Mixers**														
20	2.2.2			Technology Dev for 780-950 GHz Heterodyne Rx		1										1.90	$330,750
21					Mixer design	1	0.55			0.2			$10,000				
22					Magnetic circuit	1											
23					LO injection	1				0.1			$10,000				
24					Signal optics	1											
25					Dewar customization	1				0.1							
26					FTS measurements	1	0.05	0.05	0.1	0.05							
27					Mixer measurements	1	0.2		0.1	0.2							
28					Preamps	1											
29					LO and signal source	1		0.05	0.1	0.05							
30					Computer & peripherals	1								$4,000			
31					NbTiN development & wafer fabrication	1							$300,000				
32					Misc. hardware & materials	1					$3,000						
33					Consumables (LN, LHe)	1					$3,750						
34	**2.2.3**			**New materials for SIS mixers**		3										0.20	$300,000
35					1.4 THz signal source	3				0.1							
36					Optics	3											
37					Material development & wafer fabrication	3	0.1						$300,000				
38	**2.3**		**Specific Receiver Systems**														
39	**2.3.1**			**Continuum Radiometer Development**		3										0.45	$55,000
40					SIS continuum Rx (based on existing mxr.)	3		0.25		0.2		$55,000					
41					Instrumented dewar, pumps, etc.	3											
42					Compressor & Crosshead	3											
43					Control rack	3											
44					IF components	3											
45					SIS mixers (6)	3											
46					Preamps (6)	3											
47					LO and signal source	3											
48	**2.3.2**			**1.4 THz Receiver**		3										0.30	$0
49					Mixer development	3		0.1									
50					FTS	3											
51					Instrumented dewar, pumps, etc.	3											
52					Compressor & Crosshead	3											
53					Control rack	3											
54					IF components	3											
55					Optics	3											
56					SIS mixers (6)	3											
57					Preamps (6)	3											
58					LO source	3											
59					Magnetic circuit design & software	3		0.1		0.1							
60	**2.4**		**LO & Signal Sources**														
61	2.4.1			Highly integrated multiplier chains		2		1	0	2	$40,000			$4,000	$2,000	3.00	$46,000
62	2.4.2			Photonic LO		2	0.5	2	0	3	$100,000	$100,000		$5,000	$5,000	5.50	$210,000
63	**2.5**		**Cryogenics**														
64	2.5.1			New cryogenic technology		2		0.5	0	1.5	$15,000			$4,000	$2,000	2.00	$21,000
65	2.5.2			Cryocoolers		2		0.5	0	1.5	$20,000			$5,000	$2,000	2.00	$27,000
66	**2.6**		**Other receiver & measurement technology**														
67	2.6.1			Wideband components		2		0.5		0.5	$20,000			$5,000	$6,000	1.00	$31,000
68	2.6.2			Integration feeds & amplifiers		2		1		2	$30,000			$4,000	$5,000	3.00	$39,000
69																	
70	**3**	**Signal Processing and Transmission**															
71	3.1		Digital transmission			2		1	0	2	$8,000			$4,000	$2,000	3.00	$14,000
72	3.2		Satellite-based LO reference			2	0.5	0.5		1	$20,000			$2,000	$2,000	2.00	$24,000
73	3.3		Wide bandwidth digitization			1	0.5	0.75		1	$20,000			$100,000	$5,000	2.25	$125,000
74	**3.4**		**RFI Mitigation**														
75	3.4.1			General		2	0.5	1.5	0	1	$30,000			$10,000	$4,000	3.00	$44,000
76	3.4.2			Digital Filtering		2		2		1	$15,000				$23,000	3.00	$38,000
77	3.4.3			Spatial Nulling		2	1				$4,000			$2,000	$1,000	1.00	$7,000
78	3.4.4			Blanking and Adaptive Cancellation		2	0.5	0.5			$15,000			$10,000	$20,000	1.00	$45,000
79	3.4.5			Signal Propagation		2	0.5	0.3		0.5		$10,000		$2,000	$2,000	1.30	$14,000
80	**3.5**		**Advanced digital correlators**			1	0.5	2	0	2	$50,000		$100,000	$80,000	$2,000	4.50	$232,000
81	**3.6**		**Water Vapor Radiometers**			3	0.5	1	0	1	$30,000			$2,000	$2,000	2.50	$34,000
82																	
83																	
84																**Total M&S**	**Total FTE**
85			**All projects, funds permitting**			1,2 & 3	**7.4**	**24.6**	**0.3**	**30.9**	**$688,750**	**$265,000**	**$720,000**	**$269,000**	**$117,000**	**$2,059,750**	**63**
86																	
87																**Total M&S**	**Total FTE**
88			**Priority 1 projects, minimum funding**			1	**2.3**	**3.9**	**0.3**	**4.7**	**$86,750**	**$0**	**$420,000**	**$186,000**	**$23,000**	**$715,750**	**11**
89																	
90																**Total M&S**	**Total FTE**
91			**Priority 1 and 2 projects**			1 & 2	**6.8**	**22.7**	**0.3**	**29.2**	**$623,750**	**$210,000**	**$420,000**	**$265,000**	**$114,000**	**$1,632,750**	**59**
92																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Engineering & Technology Development**										**2007**				ARK 28 OCT 2004		
2																	
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Section	Section
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	FTE	Cost
5								engineers	engineers							Totals	Totals
6	**1**	**Antenna R & D**															
7	1.1		Focal plane arrays			1	0.5	1		1	$10,000			$2,000	$1,000	2.50	$13,000
8	1.2		Metrology			2	0.5	1		1	$30,000			$4,000	$2,000	2.50	$36,000
9	1.3		Ultra-Wideband Feeds			2	0.5	2		1	$15,000			$4,000	$2,000	3.50	$21,000
10	1.4		Physical Optics			1									$15,000	0.00	$15,000
11																	
12	**2**	**Receiver Technology**															
13	**2.1**		**Amplifiers**			2		1		2	$20,000	$100,000		$4,000	$4,000	3.00	$128,000
14	2.1.2			MMIC Technology		2		2		3	$50,000			$4,000	$4,000	5.00	$58,000
15	2.1.3			Noise theory HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
16	2.1.4			1/f noise in HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
17	2.1.5			Noise in bipolars		3		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
18	2.1.6			InP HBT technology		2		0.5		1	$35,000			$2,000	$1,000	1.50	$38,000
19	**2.2**		**SIS Mixers**														
20	2.2.2			Technology Dev for 780-950 GHz Heterodyne Rx		1										0.65	$306,750
21					Mixer design	1											
22					Magnetic circuit	1											
23					LO injection	1											
24					Signal optics	1											
25					Dewar customization	1											
26					FTS measurements	1	0.05	0.05		0.05							
27					Mixer measurements	1	0.2		0.1	0.2							
28					Preamps	1											
29					LO and signal source	1											
30					Computer & peripherals	1											
31					NbTiN development & wafer fabrication	1							$300,000				
32					Misc. hardware & materials	1					$3,000						
33					Consumables (LN, LHe)	1					$3,750						
34	**2.2.3**			**New materials for SIS mixers**		3										0.50	$400,000
35					1.4 THz signal source	3	0.1	0.1		0.2		$100,000					
36					Optics	3											
37					Material development & wafer fabrication	3	0.1						$300,000				
38	**2.3**		**Specific Receiver Systems**														
39	**2.3.1**			**Continuum Radiometer Development**		3										1.20	$22,000
40					SIS continuum Rx (based on existing mxr.)	3		1		0.2		$22,000					
41					Instrumented dewar, pumps, etc.	3											
42					Compressor & Crosshead	3											
43					Control rack	3											
44					IF components	3											
45					SIS mixers (6)	3											
46					Preamps (6)	3											
47					LO and signal source	3											
48	**2.3.2**			**1.4 THz Receiver**		3										0.35	$44,000
49					Mixer development	3		0.25		0.1		$44,000					
50					FTS	3											
51					Instrumented dewar, pumps, etc.	3											
52					Compressor & Crosshead	3											
53					Control rack	3											
54					IF components	3											
55					Optics	3											
56					SIS mixers (6)	3											
57					Preamps (6)	3											
58					LO source	3											
59					Magnetic circuit design & software	3											
60	**2.4**		**LO & Signal Sources**														
61	2.4.1			Highly integrated multiplier chains		2		1	0	2	$40,000			$4,000	$2,000	3.00	$46,000
62	2.4.2			Photonic LO		2	0.5	2	0	3	$100,000	$100,000		$5,000	$5,000	5.50	$210,000
63	**2.5**		**Cryogenics**														
64	2.5.1			New cryogenic technology		2		0.5	0	1.5	$15,000			$4,000	$2,000	2.00	$21,000
65	2.5.2			Cryocoolers		2		0.5	0	1.5	$20,000			$5,000	$2,000	2.00	$27,000
66	**2.6**		**Other receiver & measurement technology**														
67	2.6.1			Wideband components		2		0.5		0.5	$20,000			$5,000	$6,000	1.00	$31,000
68	2.6.2			Integration feeds & amplifiers		2		1		2	$30,000			$4,000	$5,000	3.00	$39,000
69																	
70	**3**	**Signal Processing and Transmission**															
71	3.1		Digital transmission			2		1	0	2	$8,000			$4,000	$2,000	3.00	$14,000
72	3.2		Satellite-based LO reference			2	0.5	0.5		1	$20,000			$2,000	$2,000	2.00	$24,000
73	3.3		Wide bandwidth digitization			1	0.5	0.75		1	$20,000			$100,000	$5,000	2.25	$125,000
74	**3.4**		**RFI Mitigation**														
75	3.4.1			General		2	0.5	1.5	0	1	$30,000			$10,000	$4,000	3.00	$44,000
76	3.4.2			Digital Filtering		2		2		1	$15,000				$23,000	3.00	$38,000
77	3.4.3			Spatial Nulling		2	1				$4,000			$2,000	$1,000	1.00	$7,000
78	3.4.4			Blanking and Adaptive Cancellation		2	0.5	0.5			$15,000			$10,000	$20,000	1.00	$45,000
79	3.4.5			Signal Propagation		2	0.5	0.3		0.5		$10,000		$2,000	$2,000	1.30	$14,000
80	**3.5**		**Advanced digital correlators**			1	0.5	2	0	2	$50,000		$100,000	$80,000	$2,000	4.50	$232,000
81	**3.6**		**Water Vapor Radiometers**			3	0.5	1	0	1	$30,000			$2,000	$2,000	2.50	$34,000
82																	
83																	
84																**Total M&S**	**Total FTE**
85			**All projects, funds permitting**			1,2 & 3	**7.0**	**25.5**	**0.1**	**30.5**	**$688,750**	**$376,000**	**$700,000**	**$265,000**	**$117,000**	**$2,146,750**	**63**
86																	
87																**Total M&S**	**Total FTE**
88			**Priority 1 projects, minimum funding**			1	**1.8**	**3.8**	**0.1**	**4.3**	**$86,750**	**$0**	**$400,000**	**$182,000**	**$23,000**	**$691,750**	**10**
89																	
90																**Total M&S**	**Total FTE**
91			**Priority 1 and 2 projects**			1 & 2	**6.3**	**22.6**	**0.1**	**28.8**	**$623,750**	**$210,000**	**$400,000**	**$261,000**	**$114,000**	**$1,608,750**	**58**
92																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Engineering & Technology Development**										**2008**				ARK 28 OCT 2004		
2																	
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Section	Section
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	FTE	Cost
5								engineers	engineers							Totals	Totals
6	**1**	**Antenna R & D**															
7	1.1		Focal plane arrays			1	0.5	1		1	$10,000			$2,000	$1,000	2.50	$13,000
8	1.2		Metrology			2	0.5	1		1	$30,000			$4,000	$2,000	2.50	$36,000
9	1.3		Ultra-Wideband Feeds			2	0.5	2		1	$15,000			$4,000	$2,000	3.50	$21,000
10	1.4		Physical Optics			1									$15,000	0.00	$15,000
11																	
12	**2**	**Receiver Technology**															
13	**2.1**		**Amplifiers**			2		1		2	$20,000	$100,000		$4,000	$4,000	3.00	$128,000
14	2.1.2			MMIC Technology		2		2		3	$50,000			$4,000	$4,000	5.00	$58,000
15	2.1.3			Noise theory HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
16	2.1.4			1/f noise in HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
17	2.1.5			Noise in bipolars		3		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
18	2.1.6			InP HBT technology		2		0.5		1	$35,000			$2,000	$1,000	1.50	$38,000
19	**2.2**		**SIS Mixers**														
20	2.2.2			Technology Dev for 780-950 GHz Heterodyne Rx		1										0.00	$0
21					Mixer design	1											
22					Magnetic circuit	1											
23					LO injection	1											
24					Signal optics	1											
25					Dewar customization	1											
26					FTS measurements	1											
27					Mixer measurements	1											
28					Preamps	1											
29					LO and signal source	1											
30					Computer & peripherals	1											
31					NbTiN development & wafer fabrication	1											
32					Misc. hardware & materials	1											
33					Consumables (LN, LHe)	1											
34	**2.2.3**			**New materials for SIS mixers**		3										0.10	$322,000
35					1.4 THz signal source	3											
36					Optics	3						$22,000					
37					Material development & wafer fabrication	3	0.1						$300,000				
38	**2.3**		**Specific Receiver Systems**														
39	**2.3.1**			**Continuum Radiometer Development**		3										1.20	$22,000
40					SIS continuum Rx (based on existing mxr.)	3		1		0.2		$22,000					
41					Instrumented dewar, pumps, etc.	3											
42					Compressor & Crosshead	3											
43					Control rack	3											
44					IF components	3											
45					SIS mixers (6)	3											
46					Preamps (6)	3											
47					LO and signal source	3											
48	**2.3.2**			**1.4 THz Receiver**		3										2.30	$383,000
49					Mixer development	3		0.5		0.2							
50					FTS	3						$250,000					
51					Instrumented dewar, pumps, etc.	3											
52					Compressor & Crosshead	3											
53					Control rack	3											
54					IF components	3											
55					Optics	3		0.5		0.2		$33,000					
56					SIS mixers (6)	3				0.3							
57					Preamps (6)	3				0.3							
58					LO source	3		0.1		0.2		$100,000					
59					Magnetic circuit design & software	3											
60	**2.4**		**LO & Signal Sources**														
61	2.4.1			Highly integrated multiplier chains		2		1	0	2	$40,000			$4,000	$2,000	3.00	$46,000
62	2.4.2			Photonic LO		2	0.5	2	0	3	$100,000	$100,000		$5,000	$5,000	5.50	$210,000
63	**2.5**		**Cryogenics**														
64	2.5.1			New cryogenic technology		2		0.5	0	1.5	$15,000			$4,000	$2,000	2.00	$21,000
65	2.5.2			Cryocoolers		2		0.5	0	1.5	$20,000			$5,000	$2,000	2.00	$27,000
66	**2.6**		**Other receiver & measurement technology**														
67	2.6.1			Wideband components		2		0.5		0.5	$20,000			$5,000	$6,000	1.00	$31,000
68	2.6.2			Integration feeds & amplifiers		2		1		2	$30,000			$4,000	$5,000	3.00	$39,000
69																	
70	**3**	**Signal Processing and Transmission**															
71	3.1		Digital transmission			2		1	0	2	$8,000			$4,000	$2,000	3.00	$14,000
72	3.2		Satellite-based LO reference			2	0.5	0.5		1	$20,000			$2,000	$2,000	2.00	$24,000
73	3.3		Wide bandwidth digitization			1	0.5	0.75		1	$20,000			$100,000	$5,000	2.25	$125,000
74	**3.4**		**RFI Mitigation**														
75	3.4.1			General		2	0.5	1.5	0	1	$30,000			$10,000	$4,000	3.00	$44,000
76	3.4.2			Digital Filtering		2		2		1	$15,000				$23,000	3.00	$38,000
77	3.4.3			Spatial Nulling		2	1				$4,000			$2,000	$1,000	1.00	$7,000
78	3.4.4			Blanking and Adaptive Cancellation		2	0.5	0.5			$15,000			$10,000	$20,000	1.00	$45,000
79	3.4.5			Signal Propagation		2	0.5	0.3		0.5		$10,000		$2,000	$2,000	1.30	$14,000
80	**3.5**		**Advanced digital correlators**			1	0.5	2	0	2	$30,000		$100,000	$80,000	$2,000	4.50	$212,000
81	**3.6**		**Water Vapor Radiometers**			3	0.5	1	0	1	$30,000			$2,000	$2,000	2.50	$34,000
82																	
83																	
84																**Total M&S**	**Total FTE**
85			**All projects, funds permitting**			1,2 & 3	**6.6**	**26.2**	**0.0**	**31.2**	**$662,000**	**$637,000**	**$400,000**	**$265,000**	**$117,000**	**$2,081,000**	**64**
86																	
87																**Total M&S**	**Total FTE**
88			**Priority 1 projects, minimum funding**			1	**1.5**	**3.8**	**0.0**	**4.0**	**$60,000**	**$0**	**$100,000**	**$182,000**	**$23,000**	**$365,000**	**9**
89																	
90																**Total M&S**	**Total FTE**
91			**Priority 1 and 2 projects**			1 & 2	**6.0**	**22.6**	**0.0**	**28.5**	**$597,000**	**$210,000**	**$100,000**	**$261,000**	**$114,000**	**$1,282,000**	**57**
92																	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	**Engineering & Technology Development**										**2009**				ARK 28 OCT 2004		
2																	
3							FTE	FTE	FTE	FTE	Materials	Test	Outside	Computer	Computer	Section	Section
4	Section					Priority	scientists	Elec/Mech	Software	technicians		Equipment	Contracts	hardware	software	FTE	Cost
5								engineers	engineers							Totals	Totals
6	**1**	**Antenna R & D**															
7	1.1		Focal plane arrays			1	0.5	1		1	$10,000			$2,000	$1,000	2.50	$13,000
8	1.2		Metrology			2	0.5	1		1	$30,000			$4,000	$2,000	2.50	$36,000
9	1.3		Ultra-Wideband Feeds			2	0.5	2		1	$15,000			$4,000	$2,000	3.50	$21,000
10	1.4		Physical Optics			1									$15,000	0.00	$15,000
11																	
12	**2**	**Receiver Technology**															
13	**2.1**		**Amplifiers**			2		1		2	$20,000	$100,000		$4,000	$4,000	3.00	$128,000
14	2.1.2			MMIC Technology		2		2		3	$50,000			$4,000	$4,000	5.00	$58,000
15	2.1.3			Noise theory HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
16	2.1.4			1/f noise in HFETs		2		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
17	2.1.5			Noise in bipolars		3		0.5		0.25	$35,000			$2,000	$1,000	0.75	$38,000
18	2.1.6			InP HBT technology		2		0.5		1	$35,000			$2,000	$1,000	1.50	$38,000
19	**2.2**		**SIS Mixers**														
20	2.2.2			Technology Dev for 780-950 GHz Heterodyne Rx		1										0.00	$0
21					Mixer design	1											
22					Magnetic circuit	1											
23					LO injection	1											
24					Signal optics	1											
25					Dewar customization	1											
26					FTS measurements	1											
27					Mixer measurements	1											
28					Preamps	1											
29					LO and signal source	1											
30					Computer & peripherals	1											
31					NbTiN development & wafer fabrication	1											
32					Misc. hardware & materials	1											
33					Consumables (LN, LHe)	1											
34	**2.2.3**			**New materials for SIS mixers**		3										0.40	$300,000
35					1.4 THz signal source	3				0.3							
36					Optics	3											
37					Material development & wafer fabrication	3	0.1						$300,000				
38	**2.3**		**Specific Receiver Systems**														
39	**2.3.1**			**Continuum Radiometer Development**		3										0.00	$0
40					SIS continuum Rx (based on existing mxr.)	3											
41					Instrumented dewar, pumps, etc.	3											
42					Compressor & Crosshead	3											
43					Control rack	3											
44					IF components	3											
45					SIS mixers (6)	3											
46					Preamps (6)	3											
47					LO and signal source	3											
48	**2.3.2**			**1.4 THz Receiver**		3										1.20	$0
49					Mixer development	3		1		0.2							
50					FTS	3											
51					Instrumented dewar, pumps, etc.	3											
52					Compressor & Crosshead	3											
53					Control rack	3											
54					IF components	3											
55					Optics	3											
56					SIS mixers (6)	3											
57					Preamps (6)	3											
58					LO source	3											
59					Magnetic circuit design & software	3											
60	**2.4**		**LO & Signal Sources**														
61	2.4.1			Highly integrated multiplier chains		2		1	0	2	$40,000			$4,000	$2,000	3.00	$46,000
62	2.4.2			Photonic LO		2	0.5	2	0	3	$100,000	$100,000		$5,000	$5,000	5.50	$210,000
63	**2.5**		**Cryogenics**														
64	2.5.1			New cryogenic technology		2		0.5	0	1.5	$15,000			$4,000	$2,000	2.00	$21,000
65	2.5.2			Cryocoolers		2		0.5	0	1.5	$20,000			$5,000	$2,000	2.00	$27,000
66	**2.6**		**Other receiver & measurement technology**														
67	2.6.1			Wideband components		2		0.5		0.5	$20,000			$5,000	$6,000	1.00	$31,000
68	2.6.2			Integration feeds & amplifiers		2		1		2	$30,000			$4,000	$5,000	3.00	$39,000
69																	
70	**3**	**Signal Processing and Transmission**															
71	3.1		Digital transmission			2		1	0	2	$8,000			$4,000	$2,000	3.00	$14,000
72	3.2		Satellite-based LO reference			2	0.5	0.5		1	$20,000			$2,000	$2,000	2.00	$24,000
73	3.3		Wide bandwidth digitization			1	0.5	0.75		1	$20,000			$100,000	$5,000	2.25	$125,000
74	**3.4**		**RFI Mitigation**														
75	3.4.1			General		2	0.5	1.5	0	1	$30,000			$10,000	$4,000	3.00	$44,000
76	3.4.2			Digital Filtering		2		2		1	$15,000				$23,000	3.00	$38,000
77	3.4.3			Spatial Nulling		2	1				$4,000			$2,000	$1,000	1.00	$7,000
78	3.4.4			Blanking and Adaptive Cancellation		2	0.5	0.5			$15,000			$10,000	$20,000	1.00	$45,000
79	3.4.5			Signal Propagation		2	0.5	0.3		0.5		$10,000		$2,000	$2,000	1.30	$14,000
80	**3.5**		**Advanced digital correlators**			1	0.5	2	0	2	$50,000		$100,000	$80,000	$2,000	4.50	$232,000
81	**3.6**		**Water Vapor Radiometers**			3	0.5	1	0	1	$30,000			$2,000	$2,000	2.50	$34,000
82																	
83																	
84																**Total M&S**	**Total FTE**
85			**All projects, funds permitting**			1,2 & 3	**6.6**	**25.1**	**0.0**	**30.3**	**$682,000**	**$210,000**	**$400,000**	**$265,000**	**$117,000**	**$1,674,000**	**62**
86																	
87																**Total M&S**	**Total FTE**
88			**Priority 1 projects, minimum funding**			1	**1.5**	**3.8**	**0.0**	**4.0**	**$80,000**	**$0**	**$100,000**	**$182,000**	**$23,000**	**$385,000**	**9**
89																	
90																**Total M&S**	**Total FTE**
91			**Priority 1 and 2 projects**			1 & 2	**6.0**	**22.6**	**0.0**	**28.5**	**$617,000**	**$210,000**	**$100,000**	**$261,000**	**$114,000**	**$1,302,000**	**57**
92																	