N91-14575

RESULTS OF THE USERS' REQUIREMENTS SURVEY

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The objectives of the High Resolution, High Frame Rate Video Technology (HHVT) Users' Requirements Survey were the following:

(1) Document the requirements of potential users of the HHVT system
(2) Establish a database relating key video parameters to HHVT users
(3) Guide the development of a high resolution, high frame rate video system offering high data storage capacity and high data transmission rates
(4) Allow users to compare their requirements to those of other users and to state-of-the-art technology
(5) Allow users to reassess, if necessary, their requirements in light of existing and near-term technology

The Users' Requirements questionnaires were distributed to the following potential microgravity HHVT users:

Data Base ID Numbers	Potential Microgravity HHVT Users
100's	LeRC project scientists of approved flight experiments
200's	LeRC project scientists of ground-based science discipline areas which may lead to future microgravity flight experiments
300's	Non-LeRC project scientists of ground-based science discipline areas which may lead to future microgravity flight experiments
400's	Microgravity Science and Applications Division principal investigators
500's	Microgravity Science and Applications Division discipline working groups
600's	Miscellaneous
700's	Private industry

The key video parameters solicited in the questionnaire for each experiment or ground-based research were

(1) Spatial resolution (in pixels/frame)
(2) Frame rate (in frames/sec)
(3) Gray scale resolution (up to 256 levels)
(4) Monochrome or color images
(5) Number of frames to be stored per experiment run
(6) Number of frames to be stored per flight
(7) Downlinking requirements

The first HHVT Users' Requirements Survey was issued in December 1986. Sixty-eight questionnaires were mailed. Seventeen of the thirty-nine completed questionnaires indicated video imaging requirements.

The same questionnaire was issued to 119 different investigators in May 1987. Eighteen of the twenty-eight completed questionnaires that were received indicated video imaging requirements.

In October 1987 the original questionnaire was mailed to fifteen more investigators. Both of the two completed questionnaires received indicated video imaging requirements. In November 1987 a different questionnaire that was written by engineers working on the HHVT project at Langley Research Center was mailed to all the investigators who had responded to the original questionnaire. This second questionnaire sought detailed information on the experimental images, image enhancement requirements, and real-time monitoring requirements. Fourteen investigators responded to the second questionnaire. Thirteen of these indicated a need for image enhancement.

The results of the HHVT Users' Requirements Survey have been tabulated and appear in Appendix I - HHVT Video Requirements Survey; Appendix II - HHVT Downlink Requirements; and Appendix III - Summary of Image-Processing Requirements appended to this report.

The formula used to calculate the downlink data rate requirement is as follows:

$$\begin{aligned}\text{Data rate (bytes/sec)} = {} & [\text{Spatial resolution (in pixels/frame)}] \\ & \times [\log_2 (\text{gray scale resolution in bits/pixel})] \\ & \times [1 \text{ byte}/8 \text{ bits}] \times [\text{downlink frames/run}] \\ & \times [1 \text{ downlink time in sec}] \times [Y]\end{aligned}$$

where

Y = 1 (for monochrome), 3 (for color)

For example, User No. 102 in the HHVT Users' Requirements database has the following requirements for the Solid Surface Combustion Experiment:

Spatial resolution = 5000 x 2500 pixels = 1.25×10^7
Gray scale = 256
Frames per run to be downlinked = 23 040
Period during which downlinking must occur = 12 hr
Color images

Data rate (bytes/sec) = [1.25×10^7 pixels/frame]
× [8 bits/pixel] × [1 byte/8 bits]
× [23 040 frames/run] × [1/12 hr] × [1 hr/3600 sec]
× [3]
= 2.00×10^7 bytes/sec

Currently, 37 potential microgravity HHVT users have submitted diverse video requirements. The requirements for spatial resolution range from 4100 pixels/frame to 100 000 000 pixels/frame (which is greater than the resolution achievable with 16 mm film). Framing rate requirements vary from four (4) per hour to 1 000 000 frames/sec. The results of the Users' Requirements Survey are as indicated in the attached appendixes (see pp. 6-17). The diversity of these requirements indicates a need for developing a video system with great flexibility. Further consideration has to be given to how the results of this survey correspond to plans being made for video systems to be installed onboard the Space Shuttle and Space Station Freedom.

APPENDIX I

HHVT VIDEO REQUIREMENTS SURVEY

--- HHVT Video Requirements Survey --- R. Ziemke 5/6/88

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	FRAME RATE	FRAMES/ RUN	FRAMES/ FLIGHT	EQ. ISO	SPECT. RESP.	NO. VIEWS
102	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Solid Surface Combustion	C	256	5000 X 2500 (1.25E7)	64	23040	69120	400	V-IR	2
103	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Gas Jet Diffusion Flames	C	256	4000 X 2000 (8.00E6)	400 100	5500	2.64E5	400	V-IR	1
104	H. Ross (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Particle Cloud Combustion	C	256	200 X 187 (3.75E4)	100	6000	48000	TBD	TBD	2
109	T. Jacobson (MS 500-205) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Surface Tension Driven Convection	BW	64	256 X 512 (1.31E5)	60	36000	5.40E5	1000	V	1
110	E. Winsa (MS 500-205) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Isothermal Dendritic Growth	BW	16	64 X 64 (4.10E3)	1/60	360	7200	100	V	2
111	J. Haggard (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Droplet Combustion	BW	TBD	600 X 600 (3.60E5)	100	3000	75000	160	.6328u	1
			C	TBD	200 X 200 (4.00E4)	100	3000	75000	400	V-IR	1
218	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Flame Spreading Over Solids in Forced Flows	C	256	7500 X 5000 (3.75E7)	100	36000	5.76E5	400	V-IR	2
225	R. Balasubramaniam (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Electro-hydrodynamics	BW	16	600 X 380 (2.28E5)	30	1800	1.00E5	TBD	V	2

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	FRAME RATE	FRAMES/ RUN	FRAMES/ FLIGHT	EQ. ISO	SPECT. RESP.	NO. VIEWS
228	J. McQuillen (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Mass Transport	BW	256	2000 X 2000 (4.00E6)	1,000 100 30	1.20E5	4.80E5	TBD	V	2
230	R. Vernon (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Nucleate Pool Boiling	BW	20	1000 X 500 (5.00E5)	1,000 100 10	7200	64800	TBD	TBD	1
234	J. Mcquillen (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Study of Forced Convection Boiling Under Reduced Gravity	BW	20	500 X 250 (1.25E5)	100 10	1800	16200	TBD	TBD	2
302	J. Baird Dept. of Physics Univ. of Alabama Huntsville, AL 35899	Extension of Ostwald Ripening Theory	BW	16	10000 X 10000 (1.00E8)	1 per 15 min	Continuous	400	100	V	1
304	A. Cezairliyan NBS Bldg. 236 Washington, DC 20234	Dynamic Thermo-physical Measure-ments in Space	BW	16	3000 X 1000 (3.00E6)	500 1000 2000	400	4000	300	V	1
305	P. Concus Lawrence Berkeley Lab Univ. of California Berkley, CA 94270	Free Surface Phenomena under Low and Zero Gravity Conditions	BW	64	200 X 200 (4.00E4)	30	2.16E4	6.55E5	10000	V-IR	3
307	R. Dressler Academic Bldg., Rm 715 George Washington Univ. Washington, DC 20052	Suppression of Marangoni Convection in Float Zones	BW	16	256 X 256 (6.55E4)	1 sec Time Exposure	1	100 (100 Time Exposures)	1000	V	1
310	P. Giarrantano NBS Boulder Laboratories Boulder, CO 80302	Transient Heat Transfer in Zero Gravity Environment	BW	256	256 X 256 (6.55E4)	2000	2000	70000	1000	V	1
312	W. Kaukler Univ of Alabama at Huntsville Huntsville, AL 35899	Direct Observation of Critical Point Wetting in Microgravity	BW	128	1024 X 1024 (1.05E6)	100	1600	1600	400	V	2
406	G. Borman Dept of Mech Eng Univ of Wisconsin Madison, WI 53706	Microgravity Combustion	BW	16	1000 X 1000 (1.00E6)	1000	100	2000	400	V	1

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	FRAME RATE	FRAMES/ RUN	FRAMES/ FLIGHT	EQ. ISO	SPECT. RESP.	NO. VIEWS
413	G. Debendetti Dept of Chem Eng Princeton Univ Princeton, NJ 08544	Disorder-order Transitions in Colloidall Suspensions	C	16	512 X 512 (2.62E5)	.0166	Cont.	10080	200	V	1
415	D. Elleman Jet Propulsion Lab Pasadena, CA	Protein Crystal Growth	C	16	256 X 256 (6.55E4)	.033	2880	20160	400	V	1
416	S. Feigelson Ctr for Materials Research Stanford Univ Stanford, CA 94305	Protein Crystal Growth	BW	32	410 X 246 (1.01E5)	.00167 30	48 8.64E5	480 8.64E6	3000	V	2
						1	1.21E6	1.21E7	3000	V	2
420	J. Hallett Desert Research Institute Univ of Nevada Reno, NV 89557	Crystallization of Spheres and Spherical Shells	BW	256	5000 X 5000 (2.50E7)	1000	1.50E4	7.50E4	100	V	1
424	P. Hrma Dept of Metallurgy & Materials Sciences Case Western Reserve Univ Cleveland, Ohio 44106	Foaming Glass Melts under Microgravity	BW	16	525 X 525 (2.76E5)	2	7200	7200	3200	V	1
427	D. Kassoy University of Colorado Boulder Engineering Center Boulder, CO 80309	Transient Effects in Combustion and Shock	C	16	512 X 512 (2.62E5)	1000	1000	1.00E4	25-1000	V	1
427A	D. Kassoy University of Colorado Boulder Engineering Center Boulder, CO 80309	Convective Diffusive Experiments	C	16	512 X 512 (2.62E5)	.01-1.0	1000	1000	25-1000	V	1
436	R. Nerem Mech Engineering Dept Univ of Houston Houston, TX 77004	Pool Boiling and External Flow Experiments	BW	16	200 X 266 (5.32E4)	200 to 6000	1000 to 8000	2.00E3 to 1.60E5	400	V	1
446	B. Singh Research & Develop Center Westinghouse Electric Corp Pittsburgh, PA	Electronic Materials	C	16	483 X 441 (2.13E5)	30	300	8.64E4	100	V	1
457	T. Wang Jet Propulsion Lab Pasadena, CA 91109	Drop Dynamics Module Upgrade	C	256	600 X 600 (3.60E5)	120	3600	3.60E6	TBD	V	1
			BW	256	300 X 300 (9.00E4	1000	5000	5.00E6	TBD	V	1

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	FRAME RATE	FRAMES/ RUN	FRAMES/ FLIGHT	EQ. ISO	SPECT. RESP.	NO. VIEWS
501	C. Bugg Univ of Alabama Birmingham, AL 3529	Protein Crystal Growth	C	128	120 X 120 (1.44E4)	.025	2160/ Day	1.30E4	200	V	1 (Movable)
504	D. Wolf Code SD4 Johnson Space Center Houston, TX 77058	Space Biotechnology	C	256	1024 X 1024 (1.05E6)	10s Time Exp	20	5400	200	.2-.9u	1
			BW	16	483 X 441 (2.13E5)	30 (Compressed Video OK)	5.40E4	4.86E6	200	.2-.9u	1
539	D. Day Materials Research Center Univ of Missouri, Rolla Rolla, MO 65401	Materials Processing in Space	C	256	300 X 500 (1.50E5)	2 10 30	9600	5.76E5	100	.45-1.0u	2
540	R. Doremus Materials Engineering Dept Rensselaer Polytech Tnst Troy, NY 12181	Melting & Crystallization of Fluoride Glasses	BW	16	100 X 100 (1.00E4)	.166	1200	1.20E4	400	V	1
558	R. Bayuzick Dept of Mech & Mat Engr Vanderbilt Univ Nashville, TN 37235	Containerless Processing	BW	256	10000 X 10000 (1.00E8)	1.00E6	2000	1.00E4	-	V-IR	1
559	G. Taylor Johnson Space Center Univ City Science Ctr Philadelphia, PA	Space Station Cytometer	C	32	128 X 128 (1.64E4)	100	5000	1.50E5	1000	.35-.80	1
601	D. Glover Mail Stop 500-207 Lewis Research Center Cleveland, Ohio 44135	COLDSAT Project	BW	64	200 X 200 (4.00E4)	4 1	3990	3.99E5	1000	V	4 per run (up to 6 available)
701	James Tegart Martin Marietta Corp. P.O. Box 179 Mail $8072 Denver, CO 80201	Storable Fluid Management Demonstration	C	TBD	483 X 441 (2.13E5)	30	5.40E4	5.40E5	TBD	V	2
702	James M. Caruthers School of Chem. Engr. Purdue University W. Lafayette, Ind. 47907	Elongational Viscosity of Polymer Solutions and Melts	BW	16	512 X 512 (2.62E5)	1000	1000	5.00E5	TBD	TBD	2

APPENDIX II

HHVT DOWNLINK REQUIREMENTS

--- HHVT Video Requirements Survey --- R. Ziemke 5/6/88

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	NO. VIEWS	DOWNLINK REQUIREMENT FRAMES/ RUN	DOWNLINK TIME	REQUIRED DATA RATE
102	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Solid Surface Combustion	C	256	5000 X 2500 (1.25E7)	2	23040	12 hr	2.00E7 Byte/sec
103	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Gas Jet Diffusion Flames	C	256	4000 X 2000 (8.00E6)	1	5500	.5 hr	7.33E7 Byte/sec
104	H. Ross (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Particle Cloud Combustion	C	256	200 X 187 (3.75E4)	2	-------- NO REQUIREMENT ---------		
109	T. Jacobson (MS 500-205) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Surface Tension Driven Convection	BW	64	256 X 512 (1.31E5)	1	-------- NO REQUIREMENT ---------		
110	E. Winsa (MS 500-205) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Isothermal Dendritic Growth	BW	16	64 X 64 (4.10E3)	2	1 Frame/min. Continuously		6.83E1 Byte/sec
111	J. Haggard (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Droplet Combustion	BW	TBD	600 X 600 (3.60E5)	1	---------- TBD ----------		
			C	TBD	200 X 200 (4.00E4)	1	---------- TBD ----------		
218	S. Olson (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Flame Spreading Over Solids in Forced Flows	C	256	7500 X 5000 (3.75E7)	2	36000	12 hr	9.37E7 Byte/sec
225	R. Balasubramaniam (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Electro-hydrodynamics	BW	16	600 X 380 (2.28E5)	2	1800	15 min	2.28E5 Byte/sec

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	NO. VIEWS	-----DOWNLINK REQUIREMENT----- FRAMES/ RUN	DOWNLINK TIME	REQUIRED DATA RATE
228	J. McQuillen (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Mass Transport	BW	256	2000 X 2000 (4.00E6)	2	100	2 Min	3.33E6 Byte/sec
230	R. Vernon (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Nucleate Pool Boiling	BW	20	1000 X 500 (5.00E5)	1	-------- NO REQUIREMENT ---------		
234	J. Mcquillen (MS 500-217) NASA-Lewis Research Center 21000 Brookpark Rd. Cleveland, Ohio 44135	Study of Forced Convection Boiling Under Reduced Gravity	BW	20	500 X 250 (1.25E5)	2	------- NO REQUIREMENT ---------		
302	J. Baird Dept. of Physics Univ. of Alabama Huntsville, AL 35899	Extension of Ostwald Ripening Theory	BW	16	10000 X 10000 (1.00E8)	1	4 Frame/hr. Continuously		5.55E4 Byte/sec
304	A. Cezairliyan NBS Bldg. 236 Washington, DC 20234	Dynamic Thermo-physical Measure-ments in Space	BW	16	3000 X 1000 (3.00E6)	1	100	10 min	2.50E5 Byte/sec
305	P. Concus Lawrence Berkeley Lab Univ. of California Berkley, CA 94270	Free Surface Phenomena under Low and Zero Gravity Conditions	BW	64	200 X 200 (4.00E4)	3	300	.5 hr	5.00E3 Byte/sec
307	R. Dressler Academic Bldg., Rm 715 George Washington Univ. Washington, DC 20052	Suppression of Marangoni Convection in Float Zones	BW	16	256 X 256 (6.55E4)	1	--------- NO REQUIREMENT --------		
310	P. Giarrantano NBS Boulder Laboratories Boulder, CO 80302	Transient Heat Transfer in Zero Gravity Environment	BW	256	256 X 256 (6.55E4)	1	--------- NO REQUIREMENT --------		
312	W. Kaukler Univ of Alabama at Huntsville Huntsville, AL 35899	Direct Observation of Critical Point Wetting in Microgravity	BW	128	1024 X 1024 (1.05E6)	2	--------- NO REQUIREMENT --------		
406	G. Borman Dept of Mech Eng Univ of Wisconsin Madison, WI 53706	Microgravity Combustion	BW	16	1000 X 1000 (1.00E6)	1	--------- NO REQUIREMENT --------		

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	NO. VIEWS	-----DOWNLINK REQUIREMENT----- FRAMES/ RUN	DOWNLINK TIME	REQUIRED DATA RATE
413	G. Debendetti Dept of Chem Eng Princeton Univ Princeton, NJ 08544	Disorder-order Transitions in Colloidall Suspensions	C	16	512 X 512 (2.62E5)	1	--------- NO REQUIREMENT --------		
415	D. Elleman Jet Propulsion Lab Pasadena, CA	Protein Crystal Growth	C	16	256 X 256 (6.55E4)	1	2880	20 min	2.36E5 Byte/sec
416	S. Feigelson Ctr for Materials Research Stanford Univ Stanford, CA 94305	Protein Crystal Growth	BW	32	410 X 246 (1.01E5)	4	2.07E6	2 hr	1.82E7 Byte/sec
420	J. Hallett Desert Research Institute Univ of Nevada Reno, NV 89557	Crystallization of Spheres and Spherical Shells	BW	256	5000 X 5000 (2.50E7)	1	1000	5 min	8.33E7 Byte/sec
424	P. Hrma Dept of Metallurgy & Materials Sciences Case Western Reserve Univ Cleveland, Ohio 44106	Foaming Glass Melts under Microgravity	BW	16	525 X 525 (2.76E5)	1	-------- NO REQUIREMENT ---------		
427	D. Kassoy University of Colorado Boulder Engineering Center Boulder, CO 80309	Transient Effects in Combustion and Shock	C	16	512 X 512 (2.62E5)	1	1000	30 min	2.18E5 Byte/sec
427A	D. Kassoy University of Colorado Boulder Engineering Center Boulder, CO 80309	Convective Diffusive Experiments	C	16	512 X 512 (2.62E5)	1	50	2 min	1.64E5 Byte/sec
436	R. Nerem Mech Engineering Dept Univ of Houston Houston, TX 77004	Pool Boiling and External Flow Experiments	BW	16	200 X 266 (5.32E4)	1	500	2 sec	6.65E6 Byte/sec
446	B. Singh Research & Develop Center Westinghouse Electric Corp Pittsburgh, PA	Electronic Materials	C	16	483 X 441 (2.13E5)	1	300	2 hr	1.33E4 Byte/sec
457	T. Wang Jet Propulsion Lab Pasadena, CA 91109	Drop Dynamics Module Upgrade	C	256	600 X 600 (3.60E5)	1	3600	10 min	6.48E6 Byte/sec
			BW	256	300 X 300 (9.00E4	1	5000	10 min	7.50E5 Byte/sec

ID	NAME	EXPERIMENT/ ACTIVITY	COLOR B/W	GRAY SCALE	SP. RES. (PIXELS)	NO. VIEWS	-----DOWNLINK REQUIREMENT----- FRAMES/ RUN	DOWNLINK TIME	REQUIRED DATA RATE
501	C. Bugg Univ of Alabama Birmingham, AL 3529	Protein Crystal Growth	C	128	120 X 120 (1.44E4)	1	20	12 hr	1.75E1 Byte/sec
504	D. Wolf Code SD4 Johnson Space Center Houston, TX 77058	Space Biotechnology	C	256	1024 X 1024 (1.05E6)	1	10	2hr	4.37E3 Bytes/sec
			BW	16	483 X 441 (2.13E5)	1	(Compressed RS170, 0.5hr per run, Real Time)		--- TBD ---
539	D. Day Materials Research Center Univ of Missouri, Rolla Rolla, MO 65401	Materials Processing in Space	C	256	300 X 500 (1.50E5)	2	(2 f/sec, 10 min per run, Real Time)		9.00E5 Bytes/sec
540	R. Doremus Materials Engineering Dept Rensselaer Polytech Tnst Troy, NY 12181	Melting & Crystallization of Fluoride Glasses	BW	16	100 X 100 (1.00E4)	1	1200	2 hr	8.33E2 Byte/sec
558	R. Bayuzick Dept of Mech & Mat Engr Vanderbilt Univ Nashville, TN 37235	Containerless Processing	BW	256	10000 X 10000 (1.00E8)	1	200	30 min	1.11E7 Byte/sec
559	G. Taylor Johnson Space Center Univ City Science Ctr Philadelphia, PA	Space Station Cytometer	C	32	128 X 128 (1.64E4)	1	---------- TBD ----------		
601	D. Glover Mail Stop 500-207 Lewis Research Center Cleveland, Ohio 44135	COLDSAT Project	BW	64	200 X 200 (4.00E4)	6	3000	24 hr	1.04E3 Byte/sec
701	James Tegart Martin Marietta Corp. P.O. Box 179 Mail $8072 Denver, CO 80201	Storable Fluid Management Demonstration	C	TBD	483 X 441 (2.13E5)	2	-------- NO REQUIREMENT --------		
702	James M. Caruthers School of Chem. Engr. Purdue University W. Lafayette, Ind. 47907	Elongational Viscosity of Polymer Solutions and Melts	BW	16	512 X 512 (2.62E5)	2	---------- TBD ----------		

APPENDIX III

SUMMARY OF IMAGE-PROCESSING REQUIREMENTS

(SURVEY RESPONSE TO LANGLEY RESEARCH CENTER REQUEST TO OBTAIN DETAILED IMAGE INFORMATION, IMAGE ENHANCEMENT REQUIREMENTS, AND REAL-TIME MONITORING REQUIREMENTS)

SUMMARY OF IMAGE-PROCESSING REQUIREMENTS

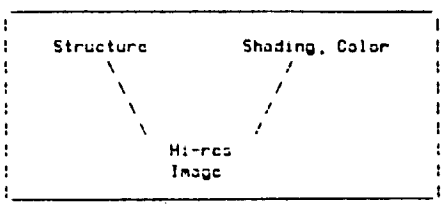
NO.	P.I.	EXPERIMENT	FEATURE	SIZE	ACCUR.	FPS	REAL-TIME NEED	R-T, LO-RES STRUCT.	IMAGE ENHANCING
1	G. Borman	Droplets	Size & Shape	100um-100mm	<5% dia.	1000	Not realistic	Yes	Structure
2	S. Olson	Flames	Edge of flame color	approx. 0.2cm	0.05mm	12-100	No	n/a	Structure & color
3	A. Dukler	Gas-liquid	Gas-liq. interface	<10in wide	0.5mm	1000	No	Yes, if R-T needed	Structure
4	R. Doremus	Crystals	Crystal form.	>100um	-	<1	Yes/essential	Not desir./better than nothing	Very helpful/to be examined
5	D. Glover	Liquid-vapor	Interface motion	-	-	-	No/but some insight useful	Some	3-D Structure
6	D. Saville	Droplets	Shape & position	1mm	-	-	Not anticipated	Yes	Structure
7	P. Giarratano	Liquid Mixtures	Spatial boundaries	Mach Zehnder interfer.	-	30	Yes	Yes	Structure
8	P. Hrma	Foaming	Cells & boundaries	2-4mm	-	-	No	No	Structure & shading
9	K. DeWitt	Bubbles/gases	Bubbles	500um	1um	1-1000	Yes	Not satisfactory	Structure & center location
10	A. Cezairliyan	Thermophysical melting	Spatial boundaries	-	<0.5%	1000	No	Yes	Structure
11	D. Day	Glass melt	Spatial boundaries	-	-	30	Yes	Yes	Structure
12	W. Kaukler	Liquid-vapor	Interface profile	-	Hi-res	>30	Yes/or sub. evaluation	No	Structure
13	C. Bugg	Crystals	Spatial boundaries	0.1-1.0mm	Hi-res	-	Yes/anticipated for the future	Yes	Structure & shading
14	S. Feigelson	Crystals	Spatial boundaries	-	0.03mm	30-120	Yes/brief inter.	No	Structure

Definitions for image coding and processing.

Structure: Edges, creases, scratches and marks that can be delineated as sharp boundaries. We can draw these boundaries as primal sketches.

Shading: We can delineate shading by intensity terracing.

Color: We can delineate color(or temperature) by intensity terracing.



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