



# NDSF Video & Data Management



- Last DeSSC Meeting
  - Described NLF award for Data Convergence & Telepresence
  - Described experiences with strawman systems on *Sally Ride* SVC
- Analysis of those experiences
- Status of telepresence study



# NDSF Video & Data Management Analysis



- Discussed common products and delivery mechanism
  - Prototype use of OpenVDM, Data Management/ Access infrastructure
- Despite outstanding support from *Capable Solutions*, concluded that OpenVDM was not really addressing the challenge we face
  - Our challenge is making access to our data—both time series/video/samples--for analysis simpler and more aligned.
  - Current focus is on using event logger/frame grabber/ VV for data and metadata generation and access, tie to imagery
  - Extension of event logger to *Alvin/Sentry*
- Expect serious effort to begin late summer



# *NDSF Video & Data Management* Engineering Use of Telepresence



- “Telepresence Use for Operational/Engineering Purposes”
  - Emphasis on telecommunications vice telepresence
- Motivation: reduction in at-sea manpower
  - Berth space issues
- Willis Group engaged to perform study/analysis
- Multiple draft reports received/revised
- Expect final delivery in immediate future, pending WHOI review and collaborative effort on recommendations with DeSSC Subcommittee on telepresence



# NDSF Video & Data Management Engineering Use of Telepresence

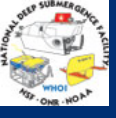


## Preliminary Findings

- No large capital investment necessary to support high bandwidth telecommunication functions on UNOLS vessels
  - Primarily bandwidth costs
  - Some equipment standardization and “capital” expenditures on software/techniques could dispel some of the nagging bandwidth fears we all have
- Low hanging fruit is shoreside data processing for *Jason*, which could save a berth.
  - On *Alvin* & *Sentry* could extend capabilities without berth space savings
  - Serious constraints imposed by launch/recovery and other “gotta be there” needs
  - Vehicle watchstanding, real-time capabilities not seen as practical by vehicle managers and others



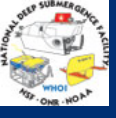
## *NDSF Video & Data Management* Engineering Use of Telepresence



- Development of extensive cost/benefit model
  - Evaluates financial impact of scenarios
  - Compares costs of shipboard technical support to shoreside support
  - Full evaluation of bandwidth costs/satellite technologies
  - Includes capitol investments, travel, operational cycles
  - Allowance for capitol investments and continuing costs over 24 years
  - Should be of benefit to Telepresence-Enabled Science Committee
- Five scenarios developed and presented in the report



# NDSF Video & Data Management Engineering Use of Telepresence



- Scenarios
  - *Jason* data processing ashore—WHOI employee replaced
  - *Jason* data processing ashore—contractor replaced
  - *Alvin* w/ data processing ashore
  - *Jason* w/ engineer (WHOI) left ashore
  - *Jason* data processing ashore w/ shoreside monitoring/situational awareness
- Intent is not that these are complete but that they are examples
- Model will be available for use by others, in particular, DeSSC subcommittee



# NDSF Video & Data Management Engineering Use of Telepresence



170531\_Cost\_Ben\_Calc.xlsx - Excel

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Global Variables				Personnel Costs				Shpboard Tech Ops - Baseline				Shoreside Tech Ops via Telecommunications Network													
Financial Multiplier	%	On-Station	Off-Station	On-Station	Off-Station	On-Station	Off-Station	On-Station	Off-Station	On-Station	Off-Station	On-Station	Off-Station	On-Station	Off-Station										
Financial multiplier (used for NPV)	0.00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>										
Annual operating cost (non-satellite)	2.00	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>										
Annual Satellite bandwidth (disco)	15%	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>										
<b>Satellite Bandwidth - Fleetwide</b>				<b>Satellite Bandwidth</b>				<b>Shoreside Tech Ops via Telecommunications Network</b>																	
Annual Fleetwide C-band ship days	1807 days/yr	Satellite	Footprint	Satellite	Footprint	Satellite	Footprint	Satellite	Footprint	Satellite	Footprint	Satellite	Footprint	Satellite	Footprint										
Annual Fleetwide Ku-band ship days	296 days/yr	C-band	33 days/yr	3 missions/yr	2 Mbit/sec	11 Mbit/sec	77 days/yr	3 missions/yr	5 Mbit/sec	C-band	33 days/yr	3 missions/yr	2 Mbit/sec	11 Mbit/sec	77 days/yr										
Annual contracted C-band bandwidth footprint	18 Mbit																								
Annual contracted Ku-band bandwidth	18 Mbit																								
<b>Annual Ship Days and Missions - C-band</b>				<b>Capital Equipment</b>				<b>Third-Party Services - C-band</b>																	
Typical total missions per year	1 cruise/yr	First Year Upgrade	First Year to Implement Upgrade	Upgrade Cycle	Annual Cost	Training	Initial Capital	Upgrade Cycle	Capital Cost	Training	Annual Fee	Contract Term													
Typical total days per mission	35 days/cruise	\$	years	years	(\$/cruise/yr)	\$/person	\$	years	(\$/yr)	\$/person	\$	years													
Typical mobilization days per mission	4 days/cruise																								
Typical demobilization days per mission	2 days/cruise																								
Typical transit + non-working days per mission	9 days/cruise																								
<b>Annual Ship Days and Missions - Ku-band</b>				<b>Quantifiable Annual Benefits</b>																					
Typical total missions per year	2 cruises/yr	Description	Benefit/Disadvantage																						
Typical total days per mission	22 days/cruise																								
Typical mobilization days per mission	4 days/cruise																								
Typical demobilization days per mission	2 days/cruise																								
Typical transit + non-working days per mission	4 days/cruise																								
<b>HSN Missions - Ku-band</b>																									
Typical total missions per year	1 cruise/yr																								
Typical total days per mission	35 days/cruise																								
Typical mobilization days per mission	4 days/cruise																								
Typical demobilization days per mission	2 days/cruise																								
Typical transit + non-working days per mission	9 days/cruise																								
<b>Travel Costs</b>																									
Travel costs per person, per mission	1000/person																								
Implementation Timeline	years																								
Years delayed implementation	1 years																								
<b>Systems Integration</b>																									
Systems integration as a % of CapEx	10%																								
<b>Summary Results</b>																									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	
<b>Shpboard Technical Operations - Baseline Costs</b>																									
Annual CapEx + Shpboard OpEx \$	-	15,177	107,498	129,859	132,268	134,719	137,218	139,764	142,357	145,000	147,693	150,436	153,229	156,078	158,980	161,936	164,947	168,016	171,143	174,328	177,574	180,881	184,250	187,684	
Cumulative CapEx + Shpboard OpEx \$	-	15,177	122,675	252,534	384,802	519,521	656,739	795,457	935,674	1,077,391	1,220,608	1,365,325	1,511,542	1,659,259	1,808,476	1,959,193	2,111,410	2,265,127	2,420,344	2,577,061	2,735,278	2,895,095	3,056,512	3,219,529	3,384,146
NPV Cumulative CapEx + OpEx \$	0	179,786	234,059	247,028	255,000	261,646	267,300	272,200	276,500	280,250	283,500	286,300	288,700	290,750	292,500	293,950	295,150	296,150	297,000	297,750	298,450	299,050	299,600	300,100	300,550
<b>Shoreside Technical Operations Costs</b>																									
Annual CapEx + Shoreside OpEx \$	-	80,723	126,516	128,601	130,720	132,875	135,066	137,293	139,556	141,854	144,207	146,614	149,075	151,590	154,159	156,782	159,459	162,190	164,975	167,814	170,707	173,654	176,654	179,706	182,810
Cumulative CapEx + Shoreside OpEx \$	-	80,723	207,239	335,840	466,560	599,435	734,491	871,744	1,011,200	1,152,856	1,296,710	1,442,764	1,591,017	1,741,470	1,894,123	2,048,875	2,205,726	2,364,675	2,525,722	2,688,867	2,854,102	3,021,427	3,190,851	3,362,374	3,536,096
NPV Cumulative CapEx + Shoreside OpEx \$	0	183,509	259,310	293,400	316,344	337,685	357,866	377,226	396,114	414,780	433,364	451,916	470,486	489,114	507,841	526,717	545,793	565,119	584,745	604,621	624,807	645,354	666,221	687,378	708,795
<b>Quantifiable Benefits / Disadvantages</b>																									
Annual Quantifiable Benefit / Disadv \$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cumulative Annual Quantifiable Benefit / Disadv \$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
NPV Cumulative Annual Quantifiable Benefit / Disadv \$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
<b>Cost / Benefit Analyses</b>																									
Net Annual Benefit / Cost of Shoreside Tech Ops	-	(25,507)	979	1,268	1,546	1,843	2,169	2,527	2,916	3,336	3,796	4,256	4,716	5,176	5,636	6,096	6,556	7,016	7,476	7,936	8,396	8,856	9,316	9,776	
Net Cumulative Benefit / Cost of Shoreside Tech Ops	-	(25,507)	(24,528)	(23,259)	(21,714)	(19,899)	(16,830)	(12,536)	(7,020)	(1,283)	3,796	9,592	16,128	23,404	31,420	40,076	49,272	58,908	68,984	79,500	90,456	101,862	113,718	126,024	138,780
NPV Cumulative Benefit / Cost of Shoreside Tech Ops	0	(24,348)	(23,452)	(22,355)	(21,051)	(19,543)	(17,838)	(15,834)	(13,530)	(10,926)	(7,922)	(4,518)	(0,614)	3,780	9,176	15,472	22,568	30,364	38,860	47,956	57,652	67,948	78,744	89,940	101,536
<b>Calculated Break-even Birth Value</b>																									
Value per Birth per Day	-	297	(8)	(19)	(10)	(18)	(24)	(29)	(34)	(39)	(44)	(49)	(54)	(59)	(64)	(69)	(74)	(79)	(84)	(89)	(94)	(99)	(104)	(109)	
<b>Cost / Benefit Calculations</b>																									
Initial Capital Equipment Costs & Periodic Reinvestments	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	
<b>Shpboard Tech Ops - Baseline</b>																									
Upgrade Capital Equipment 'A'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Upgrade Capital Equipment 'B'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Upgrade Capital Equipment 'C'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Upgrade Capital Equipment 'D'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Upgrade Capital Equipment 'E'	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Taskbar: Read Me, Data, Template, 1 JasonDataProcessor, 2 JasonDataProcessor-contractor, 3 Alvin W Data Ashore, 4 Jason leave eng ashore, 5 JasonDataProcessor w monitor

System tray: 12:32 PM, 6/1/2017



# NDSF Video & Data Management Engineering Use of Telepresence



- Scenarios
  - Some scenarios, such as *Jason* Data Processor, could conceivably pay for themselves after several years
  - More analysis necessary before we drink the Kool-Aid
  - “Value of Berth” analysis performed—what would a berth have to be worth to break even?
  - Non-quantifiable benefits
    - Additional processing
    - Productivity gains/tools?
    - Value of shoreside monitoring?
- Challenges
  - Independent operation of vessels/infrastructure
  - Infrastructure security
    - Address by cloud computing?