



**Homeland
Security**

Science and Technology

Summary

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions. Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective operational tests on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL). The SAVER Program mission includes:

- Conducting impartial, practitioner-relevant, and operationally oriented assessments and validations of emergency responder equipment;
- Providing information that enables decision makers and responders to better select, procure, use, and maintain emergency responder equipment.

Information provided by the SAVER Program will be shared nationally with the responder community, providing a life-saving and cost-saving asset to DHS, as well as to federal, state, and local responders.

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

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<https://www.rkb.us/saver>

Acoustic Surveillance Device Comparative Assessment Report

In order to provide emergency responders with information on currently available acoustic surveillance device (ASD) technologies, capabilities, and limitations, the Space and Naval Warfare Systems Center (SPAWARSYSCEN), Charleston, conducted a comparative assessment of commercially available ASDs for the SAVER Program in November 2006. Detailed findings are provided in the Acoustic Surveillance Device Comparative Assessment Report, which is available by request at <https://www.rkb.us/saver>.

Background

Law enforcement agencies use ASDs to assess threats, identify suspects, monitor suspicious activity, and evaluate incidents. An ASD is a microphone that can be connected to a radio transmitter, recorder, or set of headphones, and is designed to collect and relay or record information. Effective deployment of ASDs, integrated with additional sensor technologies (e.g., thermal imaging devices, video cameras), provides real-time data necessary for agency response to criminal activities or emergency incidents.

ASDs are used in both tactical and non-tactical law enforcement situations. Tactical situations involve activities where law enforcement practitioners, the general public, or hostages may be in danger. Non-tactical situations involve surveillance, investigative, and observation activities where there is no immediate threat to life or property.

Assessment

Prior to the assessment, SPAWARSYSCEN, Charleston, conducted a market survey in order to compile information on commercial off-the-shelf (COTS) ASDs and included results in a product and vendor list. Then, two focus groups consisting of 18 emergency response practitioners from various regions of the country met in February 2006 to identify equipment selection criteria for the assessment, determine evaluation criteria, and recommend assessment scenarios.

Each product identified in the product and vendor list was scored based on how well it met selection criteria identified by the focus group. The contact microphones, parabolic dish microphones, and body wires that received the highest scores for each of the participating vendors were selected for assessment. In some cases, multiple vendors provided information on devices developed by the same manufacturer. In those cases, the least expensive device was procured.

The selected devices included four contact microphone sets, four parabolic dish microphones, and two radio frequency (RF) body wires. The two RF body wires required a receiver to complete the system. The Citation 20 Receiver/Recorder from Tactical Technologies Inc., compatible with both RF

body wires, was procured for the comparative assessment. The devices included:

- Super Sensitive Audio Probe 1-Watt Amp (ASV-1) contact microphone (The Spy Store Inc.)
- Tactical Audio Kit CM-30 contact microphone (Daniel Technology Inc.)
- Fiber Optical Stethoscope (FOS) contact microphone (Optoacoustics Ltd.)
- Delsar Life Detector (LD3) contact microphone (Search Systems Inc.)
- Dan Gibson 18-inch parabolic dish microphone (Mace Homeland Security Group Inc.)
- Detect Ear 20-inch parabolic dish microphone (BrickHouse Electronics Inc.)
- Parabolic Acoustical Listening Device (PALD-06) 6-inch parabolic dish microphone (Sound and Optics Systems Inc.)
- SCI-BIONIC 12-inch parabolic dish microphone (Spy Chest Inc.)
- Covert Transcorder JOEY 2 Transcorder (CTR-758) RF body wire (Tactical Technologies Inc.)
- 1-Watt Synthesized Transmitter/Digital Recorder (LEA 97178) RF body wire (Law Enforcement Associates Inc.)

The ASD assessment scenarios concentrated on detecting, identifying, and recognizing a sound source. In the scenarios, controlled variables were introduced, including distances between the sound source and the ASD, movement and positioning of the sound source and ASD, and introduction of discrete noises. The variables introduced in each scenario were dependent upon the type of ASD.

In addition, the evaluation criteria were dependent upon the device type, resulting in three sets of evaluation criteria for the comparative assessment. The contact microphones and parabolic dish microphones' evaluation criteria fall within four SAVER Program categories—affordability, capability, deployability, and usability. RF body wires' evaluation criteria fall within three SAVER Program categories—affordability, capability, and usability.

Assessment Results

Evaluators rated the ASD components on the criteria established by the focus group. Each criterion was prioritized within the SAVER Program categories and was then assigned a weighting factor. The SAVER category and composite scores are shown in tables 1,

SAVER Program Category Definitions

Affordability: This category groups criteria related to life-cycle costs of a piece of equipment or system.

Capability: This category groups criteria related to the power, capacity, or features available for a piece of equipment or system to perform or assist the responder in performing one or more responder-relevant tasks.

Deployability: This category groups criteria related to the movement, installation, or implementation of a piece of equipment or system by responders at the site of its intended use.

Maintainability: This category groups criteria related to the maintenance and restoration of a piece of equipment or system to operational conditions by responders.

Usability: This category groups criteria related to the quality of the responders' experience with the operational employment of a piece of equipment or system. This includes the relative ease of use, efficiency, and overall satisfaction of the responders with the equipment or system.

2, and 3. Higher scores indicate better equipment performance.

The following paragraphs provide a brief summary of evaluator comments on each device. The equipment is listed by composite score (highest to lowest). For the purposes of the SAVER Summary, SAVER Program category scores are normalized and rounded to the nearest whole number. The full assessment report includes a breakdown of evaluator ratings by individual criterion.

Contact Microphones

The least expensive contact microphone, the ASV-1, received the highest overall product rating of the contact microphones assessed. The CM-30, FOS, and LD3, however, were not far behind as shown in table 1.

ASV-1

At a cost of \$299.00 and \$42.00 for shipping and handling at the time of purchase, the affordability of the ASV-1 was considered *very good to excellent*. One practitioner commented that the ASV-1 works very well for the cost. Capability and usability were evaluated as *adequate to very good*, although the ASV-1 was only *marginal to adequate* at filtering out background noise. One practitioner remarked that he heard static when listening for the sound source. Another practitioner noted that the ASV-1's




Table 1. Contact Microphones Assessment Results

| Model | Composite Score | Affordability (31% Weighting) | Capability (28% Weighting) | Deployability (15% Weighting) | Maintainability (N/A) | Usability (26% Weighting) |
|-------|-----------------|-------------------------------|----------------------------|-------------------------------|-----------------------|---------------------------|
| ASV-1 | 81 | 90 | 74 | 82 | N/A | 78 |
| FOS | 72 | 60 | 72 | 86 | N/A | 78 |
| LD3 | 69 | 50 | 70 | 76 | N/A | 88 |
| CM-30 | 65 | 40 | 74 | 80 | N/A | 76 |

Notes: Scores contained in the complete assessment report may be listed in a different numerical scale. For the purposes of the SAVER Summary, SAVER category scores are normalized and rounded to the nearest whole number.




N/A = not assessed

performance was affected by the weather (rain). In the area of deployability, the ASV-1 was evaluated as *very good* to *excellent*. One practitioner mentioned that if the headphones were better quality, the ASV-1 would have been even better.

| | | |
|--|---|--|
|  |  | <ul style="list-style-type: none"> Very good to excellent affordability and deployability |
| |  | <ul style="list-style-type: none"> Static during operations |
| | ASV-1 | Composite Assessment Score: 81 |

FOS

At a cost of \$1,815.00 and \$90.00 for shipping and handling, the affordability of the FOS was considered *adequate*. Capability and usability were evaluated as *adequate* to *very good*, although the FOS was only *marginal to adequate* at filtering out background noise. One practitioner had difficulty distinguishing between the radio background noise and the sound source. He commented that the FOS was very poor at filtering outside noises and vehicles passing by would drown out the sound source. In the deployability category, the FOS was evaluated as *very good* to *excellent*.




| | | |
|---|---|--|
|  |  | <ul style="list-style-type: none"> Very good to excellent deployability Adequate to very good capability and usability |
| |  | <ul style="list-style-type: none"> Marginal to adequate at filtering out background noise |
| | FOS | Composite Assessment Score: 72 |

LD3

At a cost of \$12,986.00, including shipping and handling, the affordability of the six seismic sensor LD3 kit was considered *marginal to adequate*. One practitioner noted that the LD3 was very pricey, but great quality. Capability and deployability were evaluated as *adequate* to *very good*, although the LD3 was *very good* to *excellent* at filtering out background noise. One practitioner observed increased distortion as the sound source moved closer to the sensor.




Usability was evaluated as *very good* to *excellent*.

The LD3 kit includes two methods of attaching the seismic sensors—magnetic sensor clamps and sensor spikes. In this assessment, two seismic sensors were attached to the magnetic sensor clamps and then placed along the metal frame of an interior door adjoining the room, which contained the sound source. An exterior assessment was also performed with the sensors hand-held against the exterior window. One practitioner commented that the LD3 filters background noise well; however, it was impractical in this scenario because there was no way to attach the sensors to the window. Also, the LD3 was bulky with bright orange sensors that were not very covert. The LD3 kit is more often used in search and rescue operations where counter-detection is not an issue.

| | | |
|--|---|---|
|  |  | <ul style="list-style-type: none"> Great quality Very good to excellent usability Very good to excellent at filtering out background noise Adequate to very good capability and deployability |
| |  | <ul style="list-style-type: none"> Marginal to adequate affordability |
| | LD3 | Composite Assessment Score: 69 |

CM-30

The Tactical Audio Kit includes a variety of microphones, and the one used for this assessment was the CM-30 high output wide band microphone. At a cost of \$3,235.00, including shipping and handling, the device was considered marginally affordable. Capability and usability were evaluated as *adequate* to *very good*, although the CM-30 was *very good* to *excellent* at filtering out background noise. One practitioner commented that the CM-30 filters background noise very well and was very easy to operate. Another practitioner remarked that there were too many switches and buttons, therefore, he did not like operating the CM-30. In addition, one practitioner noted some interference caused by a walkie-talkie being operated in close proximity to the sensor. Deployability was evaluated as *very good*.

| | | |
|---|--|---|
|  |  Pros | <ul style="list-style-type: none"> Filters background noise well Easy to operate Very good deployability |
| |  Cons | <ul style="list-style-type: none"> Too many switches and buttons |
| CM-30 | Composite Assessment Score: 65 | |

Parabolic Dish Microphones

The Dan Gibson and the Detect Ear received the highest overall product ratings of the parabolic dish microphones assessed as shown in table 2. The PALD-06 and the SCI-BIONIC received the lowest

overall product ratings of the parabolic dish microphones assessed.

Detect Ear

At a cost of \$519.50 and \$49.50 for shipping and handling, the affordability of the Detect Ear was considered *very good* to *excellent*. One practitioner commented that the Detect Ear was very affordable relative to similar devices used for remote listening. Capability, usability, and deployability were evaluated as *adequate* to *very good*, although the size of the device resulted in a *poor* to *marginal* rating for stealth deployment. Background and ambient noise, particularly traffic sounds, adversely impacted the Detect Ear. One practitioner noted, however, that the equalizer function was very helpful in isolating the conversation and the Detect Ear could be useful in certain circumstances for enhancement of speech (surveillance).

Other practitioners mentioned that the Detect Ear was simple to operate with limited operator training, and the headphones were very comfortable. The six parabolic dish snap-in panels and release tabs, however, were not very durable. The plastic snap-in panels were easy to assemble, but two of the six tabs broke when the Detect Ear was disassembled for storage. One practitioner commented that he was satisfied with the quality of the Detect Ear and it could have potential use in urban areas during the night. Although there was slight distortion, the practitioners



Law Enforcement Officer Using Parabolic Dish Microphone




Table 2. Parabolic Dish Microphones Assessment Results

| Model | Composite Score | Affordability (31% Weighting) | Capability (28% Weighting) | Deployability (15% Weighting) | Maintainability (N/A) | Usability (26% Weighting) |
|------------|-----------------|-------------------------------|----------------------------|-------------------------------|-----------------------|---------------------------|
| Detect Ear | 73 | 90 | 62 | 66 | N/A | 70 |
| Dan Gibson | 71 | 70 | 62 | 88 | N/A | 72 |
| SCI-BIONIC | 54 | 54 | 50 | 64 | N/A | 52 |
| PALD-06 | 37 | 34 | 34 | 60 | N/A | 30 |

Notes: Scores contained in the complete assessment report may be listed in a different numerical scale. For the purposes of the SAVER Summary, SAVER category scores are normalized and rounded to the nearest whole number.

N/A = not assessed




were able to identify the sound source at all assessment distances.

| | |
|---|--|
|  |  Pros <ul style="list-style-type: none"> • Very good to excellent affordability • Adequate to very good capability and usability • Simple to operate • Comfortable headphones |
| |  Cons <ul style="list-style-type: none"> • Background and ambient noise interfered with capability • Too large for stealth deployment • Not very durable snap-in panels |
| Detect Ear | Composite Assessment Score: 73 |

Dan Gibson

At a cost of \$795.00 and \$85.00 for shipping and handling, the affordability of the Dan Gibson was considered *adequate to very good*. Capability and usability were also evaluated as *adequate to very good*, although the size of the device resulted in a *marginal* rating for stealth deployment. One practitioner commented that the Dan Gibson sound quality was very good when there was no traffic and little ambient sound. Using the “V” setting on the equalizer, he was able to identify the sound source at all assessment distances without any strain. Another practitioner noted that he was very impressed with the simplicity and effectiveness of the Dan Gibson. Other practitioners remarked, however, that the Dan Gibson was extremely affected by ambient sound and the headphones were just *okay*. In the deployability category, the Dan Gibson was evaluated as *very good to excellent*.




Microphone sensitivity was an issue for the Dan Gibson and, as discussed in the instruction manual, the practitioners noted less self-noise when wearing a glove while holding the device. The Dan Gibson took 3 weeks to procure, which was at least 2 weeks longer than the procurement time of the other devices.

| | |
|---|--|
|  |  Pros <ul style="list-style-type: none"> • Very good to excellent deployability • Good sound quality • Simple and effective • Adequate to very good affordability |
| |  Cons <ul style="list-style-type: none"> • Affected by ambient sound • Long procurement lead time • Too large for stealth deployment |
| Dan Gibson | Composite Assessment Score: 71 |

SCI-BIONIC

At a cost of \$219.99, including shipping and handling, the affordability of the SCI-BIONIC was considered *marginal to adequate*. Capability and usability were also evaluated as *marginal to adequate*, although the SCI-BIONIC was *poor to marginal* at filtering out background noise. One practitioner commented that the SCI-BIONIC kept picking up ambient sounds from all directions without allowing the operator to determine the direction of origin and thus scrambled the target. Sound quality degradation was caused by environmental noise and any traffic in the vicinity. In the deployability category, the SCI-BIONIC was evaluated as *adequate to very good*.

The same practitioner who commented on the simplicity and effectiveness of the Dan Gibson and the potential usefulness of the Detect Ear noted that the SCI-BIONIC did not seem to provide much gain over the naked ear. Another practitioner commented that he had difficulty hearing the sound source and was unable to identify the sound source at 300 feet. The first SCI-BIONIC parabolic dish microphone received from Spy Chest Inc. was defective and did not operate. Spy Chest Inc. provided a replacement unit within 2 days.




| | |
|--|---|
|  |  Pros <ul style="list-style-type: none"> • Adequate to very good deployability • Short replacement time |
| |  Cons <ul style="list-style-type: none"> • Marginal to adequate affordability, capability, and usability • Unable to filter out ambient sounds |
| SCI-BIONIC | Composite Assessment Score: 54 |

PALD-06

At a cost of \$2,450.00, including shipping and handling, the affordability of the PALD-06 was considered *poor to marginal*. Capability and usability were also evaluated as *poor to marginal*, although the size of the device resulted in an *adequate* rating for stealth deployment. One practitioner noted that the headphones were extremely comfortable and he liked the appearance of the product. Other practitioner comments emphasized poor sound quality and interference from background noises. In the deployability category, the PALD-06 was evaluated as *adequate*.

The same practitioner who commented on the simplicity and effectiveness of the Dan Gibson and the potential usefulness of the Detect Ear noted that he

found no practical use for the PALD-06 as assessed. The practitioners noted during the assessment that the PALD-06 performed poorly. The sound detected by the device was distorted with excessive background noise even at relatively short distances. Another practitioner commented that the PALD-06 was only a little clearer than the un-aided ear as used in the assessment, but thought the PALD-06 could be useful in a night operation where there was little noise.

| | | |
|---|--|--|
|  |  Pros | <ul style="list-style-type: none"> • Adequate for stealth deployment • Extremely comfortable headphones |
| |  Cons | <ul style="list-style-type: none"> • Poor to marginal affordability, capability, and usability • Poor sound quality • Background noise interference |
| PALD-06 | | Composite Assessment Score: 37 |




Radio Frequency Body Wires

Both of the assessed RF body wires performed exceptionally well. However, the more expensive RF body wire, the JOEY 2, received a slightly better overall product rating than the LEA 97178 as shown in table 3.

JOEY 2

At a cost of \$4,156.70, including shipping and handling, the affordability of the JOEY 2 was considered *adequate to very good*. Capability and usability were evaluated as *very good to excellent*, and two practitioners commented that it sounded just as good from 450 feet as it did from 50 feet. However, at 450 feet, a couple of practitioners noted that the sound was intermittent and there was static and popping.

The JOEY 2 performed well overall and had an effective transmission range of four tenths of a mile as demonstrated in the moving vehicle scenario.

| | | |
|--|--|--|
|  |  Pros | <ul style="list-style-type: none"> • Very good to excellent capability and usability • Adequate to very good affordability |
| |  Cons | <ul style="list-style-type: none"> • Sound was intermittent and static was heard at 450 feet from receiver |
| JOEY 2 | | Composite Assessment Score: 83 |

LEA 97178

At a cost of \$2,595.00, including shipping and handling, the affordability of the LEA 97178 was considered *adequate to very good*. Capability was evaluated as *very good*. One practitioner noted, however, that there was a big difference in the sound fidelity going from 350 to 450 feet, although he was still able to identify the sound source at 65 dB. Another practitioner commented that he heard static at 450 feet. Usability was evaluated as *very good to excellent*, although the LEA 97178 does require use of a computer to reprogram the transmitting frequency, which is a potential drawback to field operations. One practitioner commented that the LEA 97178 did not work well in windy conditions and traffic affected the quality of reception. She also mentioned that the LEA 97178 was very comfortable to wear, but it did get warm.


The LEA 97178 performed well overall and had an effective transmission range of one quarter of a mile as demonstrated in the moving vehicle scenario. Practitioner comments were favorable noting that the LEA 97178 worked better than body wires used by their particular police departments.

Table 3. RF Body Wires Assessment Results

| Model | Composite Score | Affordability (36% Weighting) | Capability (33% Weighting) | Deployability (N/A) | Maintainability (N/A) | Usability (31% Weighting) |
|-----------|-----------------|-------------------------------|----------------------------|---------------------|-----------------------|---------------------------|
| JOEY 2 | 83 | 70 | 92 | N/A | N/A | 90 |
| LEA 97178 | 76 | 66 | 80 | N/A | N/A | 82 |

Notes: Scores contained in the complete assessment report may be listed in a different numerical scale. For the purposes of the SAVER Summary, SAVER category scores are normalized and rounded to the nearest whole number.

N/A = not assessed

| | | |
|---|---------------------------------------|---|
|  | Pros | <ul style="list-style-type: none"> Adequate to very good affordability Very comfortable to wear Very good to excellent usability Very good capability |
| | Cons | <ul style="list-style-type: none"> Did not work well in windy conditions Static at 450 feet from receiver Requires use of computer to reprogram transmitting frequency Traffic affected quality of reception Unit got warm |
| LEA 97178 | Composite Assessment Score: 76 | |

Conclusion

The results of the ASD comparative assessment are intended to assist law enforcement and emergency response agencies with acquisition and operational decisions.

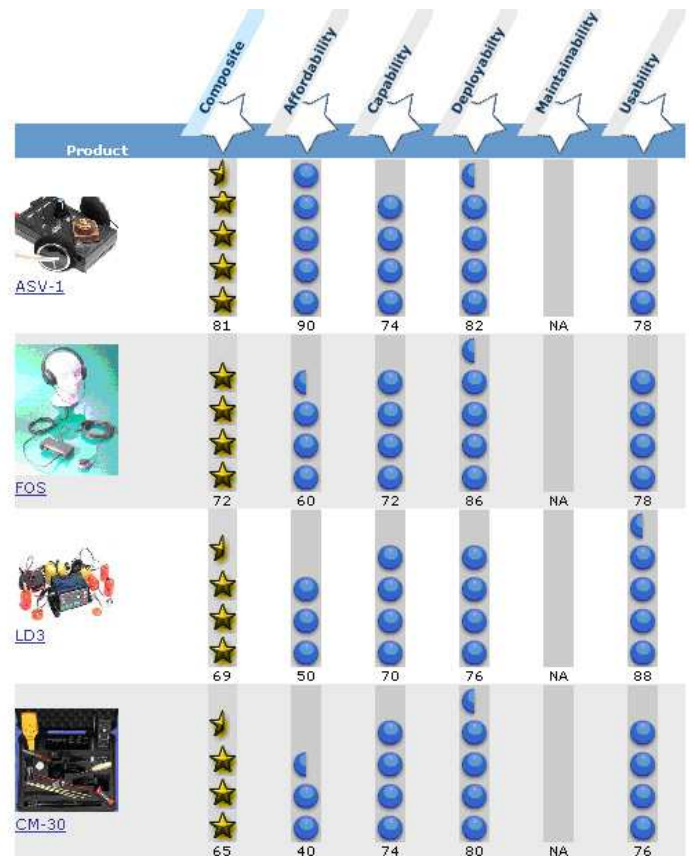
The least expensive contact microphone, the ASV-1, received the highest overall product rating of *very good*. The CM-30, FOS, and LD3, however, were not far behind with *adequate* to *very good* overall product ratings.

There is a separation between the ratings of the top two and bottom two parabolic dish microphones. Of the parabolic dish microphones assessed, the Dan Gibson and the Detect Ear received the highest overall product ratings. The PALD-06 and the SCI-BIONIC received the lowest overall product ratings of the parabolic dish microphones assessed.

Both of the assessed RF body wires performed exceptionally well. The overall product ratings for the JOEY 2 and the LEA 97178 were very similar. However, the more expensive RF body wire, the JOEY 2, received a somewhat better overall product rating of *very good to excellent*. Using the same RF receiver for both body wires ensured a controlled variable for the reception and processing of the transmission. Use of either device with a different make or model receiver may result in different conclusions.

QuickLook Snapshots

Contact Microphones

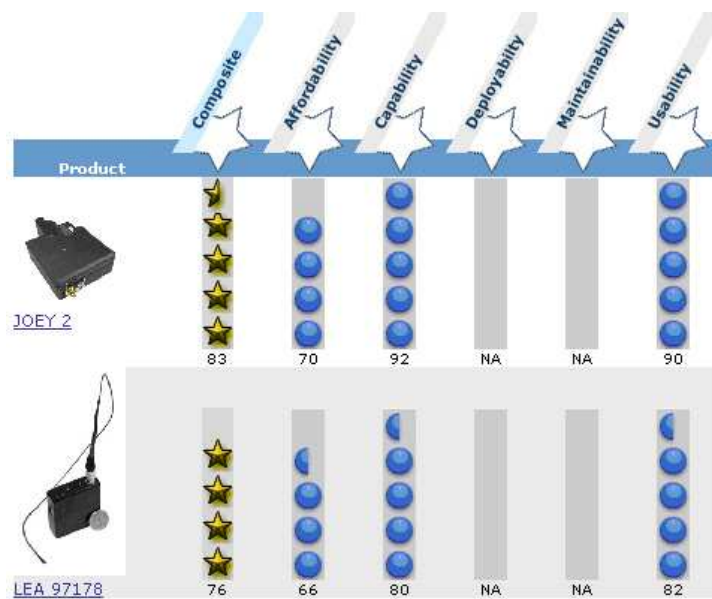


Parabolic Dish



QuickLook Snapshots (Continued)

RF Body Wires



All reports in the series, as well as reports on other technologies, are available by request at <https://www.rkb.us/saver>.